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April 10, 1924

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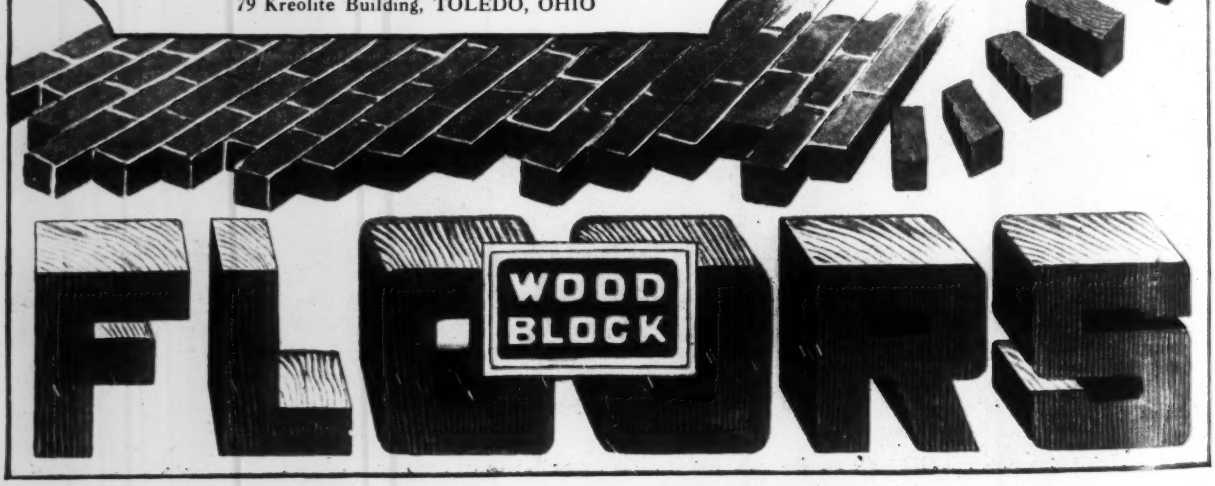

FLOORS

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ENGINEERING NEWS-RECORD

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DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

Volume 92 NEW YORK, APRIL 10, 1924 Number 15

A Do-Nothing Congress

FOR four months Congress has been in session. Presumably it has been sitting every working day and the *Congressional Record* gives evidence that the individual members have been talking. But winter turns into spring; summer, with adjournment, impends, and the federal legislature does not legislate. Its real function has been subordinated to the inquisitorial activities of two committees of the Senate, activities which are obviously partisan and political in motive, whatever may be the real benefit to the country that may flow from them. In these days of doubtful party majorities Congress bloweth where it listeth and no man knoweth whence it comes or whither it goes. The best the citizen can do is to take every opportunity he can to remind his individual representative that there are things in Washington that need the doing and that they are not all confined to examining ex- and prospective convicts, or in attempting to prove that government officials are corrupt or inefficient. Congress itself can well forget its investigating committees.

Bonus and Super-Tax

IT MAY be too much to expect that politics will be forgotten long enough to force legislative action on such things as Muscle Shoals, the Colorado River, the Department of Public Works, and similar necessary measures in which engineers are interested. But certainly something will have to be done in the matter of taxes. The punitive theory of taxation apparently still prevails in the House, in spite of the obvious fact that under it the government's income continues to decrease from those very sources toward which the theory is directed. The House, too, overwhelmingly favors a soldier bonus. The Senate, fortunately, is more cautious and may be able to resist, by a sufficient majority to sustain a certain veto, the supposed vote-getting value of a soldiers' bonus which will make necessary for many years a continuance of the present burden of heavy taxation. Nothing is more certain than the economic relation between high taxes and the high cost of living, but nothing is harder to convey to the individual whose margin of income over outgo is small or nonexistent. The ex-soldier who gets a few hundred dollars from the bonus will soon pay many times that amount in the higher costs of the things he buys—costs that would fall with the reduction of the tax burden on those who manufacture and sell him goods. But those tax burdens cannot be reduced if we must pay out hundreds of millions of dollars every year to strong and healthy American young men who served their country in 1917 and 1918. Economics does not enter into the attitude of the House on either the bonus or the supertax; sentimentalism and vote-getting have controlled. Let us hope that the Senate will contain enough men to see clearly the mathematics of the government's income and outgo as so admirably set forth by the Secretary of the Treasury.

Teaching Road Costs

DEMONSTRATION of construction methods is a means of stabilizing contract prices which very few highway officials have employed. Could they not with advantage employ it more often? The thought is suggested by the work which the Pennsylvania highway department has undertaken to devise and demonstrate methods of building its new design of concrete pavement and concrete base, described in this issue. With its thickened edges, unusual bar reinforcement, doweled center joint, and inlaid traffic strip, the new design has not shown in the bidding prices the reduction which its lesser volume of concrete and steel would appear to warrant. Contractors fear that increased construction costs will counterbalance the saving in materials. They anticipate that, compared with the previous monolithic, mesh-reinforced slab, daily yardages will be reduced by a longer time required to place reinforcement and the center-joint plate and dowels; that putting in the white cement traffic line will be expensive and will delay progress, and that the broken plane of the slab bottom will increase subgrading costs. Until convinced that this fear is groundless it will be reflected in higher prices bid and until actual costs, within reasonable limits, are known the bids will be erratic. Altogether the Pennsylvania highway officials are showing sound judgment in the situation by arranging to determine the facts by an actual road building operation.

Why Not a Civilian Engineer?

WITH no disparagement whatever of the three distinguished army engineers who have been delegated to form the American engineering commission on the feasibility and economy of the St. Lawrence waterway and power development, we think that the President should have appointed some civilian engineers to the board. The St. Lawrence problem is as much a power problem as it is one of navigation and commerce. Colonels Jadwin, Kelly and Pillsbury are fitted by training and experience to analyze waterway requirements but of the three only Colonel Kelly has had any great amount of water power experience and even he—through his Federal Power Commission connection—has been concerned more with the administration and study of hydro-electric systems than in the actual design and commercial operation of such systems. The crux of the St. Lawrence scheme lies in its water-power possibilities. One man's guess is about as good as the next one's on the possible use for navigation but whether it will pay or not depends upon the cost of producing

power and the probable demand for such power. On these questions the army engineers themselves will admit that there are many civilians much better fitted to decide. The President should see that such civilians are attached to the board, not in a subsidiary position but on a par with the officers whom the Secretary of War has selected.

Rail Capital Not All Mileage

ONE of the most frequently repeated arguments in favor of a reduction of the capitalization of the railroads is that increase in capitalization should be measured by an increase in mileage and in the number of cars and engines and that when there is no such increase the increased capital is just "water." At first glance this looks so plausible that many people believe it, forgetting the millions of new capital that are required for terminal facilities, for second tracks, for improved safety devices and signals, for line and grade improvements, and for grade separation in cities. Each year, too, a considerable mileage of track is abandoned and many cars and engines wear out and are scrapped and as the new equipment which replaces them is larger and more expensive the increase in value of the old over the new is a legitimate capital charge. The past year was one of marked improvement in railway facilities, with an expenditure of over a billion dollars, and yet the statistics, though they show a considerable increase in the number of cars and engines, also show a decrease in the miles of line operated due to the excess mileage of abandoned tracks over new tracks in service. There is no better proof of the fallacy of the unqualified setting of increased mileage over against increased capital as a measure of valuation than such figures.

Home Talent Again

EVERY TIME a city retains an outside consulting engineer there is resentment, sometimes suppressed sometimes expressed, by the local engineers. Home talent in every field demands home patronage. A typical case in a western city has just been reported. A Chicago engineer has been retained by the city to make a survey of the sewage situation and the local engineering society secretary gives out the following protest: "We are opposed to the selection of any outsider when we feel that there are at least a dozen men right here well qualified to make the survey. For instance, one of our engineers served in the office of the city engineer from back in the eighties up until a few years ago. During that time he laid out practically every sewer system in the city, and understands the needs and conditions thoroughly. Blank will have to spend many days in familiarizing himself with conditions here that are already understood by our engineers." Such an attitude is natural, but hardly logical. Leaving aside the argument of the better perspective of the outside man especially over that of a man who has been forty years with his nose to this one grindstone—what would happen to the business of consulting engineering if only local men are to be employed. Wouldn't these very engineers who want this job try to get an engagement in another city? Or are they proposing a Chinese wall which will keep people from getting out just as well as from getting in?

Watching Building Volume

LAST week the Building Congress of New York City issued a warning to all those who plan and finance construction in the metropolitan area. There is too much work being projected there, the Congress committee says, and the inevitable result is going to be a competitive demand for labor and materials which will send both skyhigh in price, to the demoralization of the whole building business in the greater city and its suburbs. How far we have come in a few short years. Before the war such a warning would have been impossible. Every one then would have gone gladly up on the rising wave of demand, confident that such a wave spelled only continued work and continued profits. But we have learned now how easy it is to exhaust supplies of labor and material and how dangerous such an exhausted supply is to estimates and bids. Those estimates and bids once passed in actual construction, the result is a scramble to see which can get from under quickest with consequent disorganization of the industry and panic. Building in New York is as high or slightly higher than last year—which was weathered successfully—but to let it run higher is to court trouble. Building congresses or similar organizations elsewhere would do well to look into the situation in their own community.

Contracts vs. Force Account on the Mississippi

SOME weeks ago a lengthy hearing was held before a congressional committee at Washington in answer to a protest from a number of Mississippi River levee contractors against the growing practice of the Mississippi River Commission of building levees by force account. No action has as yet been taken by the committee or by Congress, but the testimony itself was interesting as an example of the complications surrounding any complete pronouncement on the ever-present controversy on day-labor against contract methods of government construction.

In effect, the contractors charged that the Commission takes only the easy work for its own forces, that it compares the unit prices of such work to those of the contractors to the disparagement of the latter, that in reality the government work costs more and that finally the inspection on government work is lax so that the completed levee is neither up to the standard required of the contractor or safe. The contractors ask that a law be passed requiring that at least 75 per cent of the levee work be done by contract; the Commission now has discretion as to method but somewhat more than half is being done by government force account.

The charges against the Commission were not made so specifically as recorded in the preceding paragraph, and the Commission's reply was therefore not specific either, but it was in effect a denial of the premises of the charges. It contends that it has to maintain levee building forces as a more flexible means of shifting work to meet the constant emergencies of the river and as a protection against unreasonably high prices from contractors; it admits that the one stretch of government-built levee cited by the contractors was not up to the standard required by specification but denies that the deficiency is important and affirms that had the defects been made up the final costs would have been

still below the contractors' bids or the contract costs on similar work. It denies any animus against the contractors but maintains that with an imposed 75 per cent assignment to contract work the proper control of the river would be dangerously hampered and the present restraint on excessive contract prices removed.

The history of Mississippi levee construction is necessary to a fuller understanding of the case. Originally these levees were all built by hand, a hand-loaded two-mule team being the principal tool. Such a method was peculiarly well adapted to the contract system, because of the small investment in machinery and the personal control of negro labor that the contractor can best supply. Various things, mainly a desire for that economy which has always followed the substitution of machinery for men, but partly a desire to set up some controlled competition in bidding, led the Commission about ten years ago to experiment with machine built levees. Large draglines, cableways and tower excavators were purchased by the government and put to work on various sections in competition with old hand methods.

There has been much discussion as to the security of the levees so built, the older river men in particular being reluctant to admit their stability as compared with the compacted earthwork of the historic method. There is no precise way of comparing the two types, but it is significant that the service record of the machine built levees in floods has been quite equal to that of the older type.

The Commission became convinced that the machines were a success and so has invested a considerable sum in such equipment, a sum not within the means of most of the levee contractors, who with some notable exceptions have continued to do most of their work with mule cart and negro. The government, however, now has the equipment and to realize on the investment must continue to use it where in the opinion of the Comission its use results in lower costs than can be met by the contractor.

The Mississippi River work, therefore, is not a fair example of either the faults or virtues of day-labor construction. Under normal conditions the community is better served by having construction done by contract. Indeed, government bodies are under some obligation to foster the construction industry by giving it work which will permit it to maintain organizations and carry equipment so that it will be prepared to conduct the vast and steadying business of construction with economy to the community. But the Mississippi levee work is not normal.

Because it is of a singular type it is removed from general contractor competition and the close bidding that brings. Because it is a continuing work the engineers become fully as expert in the construction methods as those contractors who specialize in it. The government can purchase mechanical plant at high first cost and distribute that cost over a long time and many projects, something that the individual contractors cannot do unless assured of longer term contracts than appropriations warrant, river conditions demand or public policy makes advisable. Finally, it is removed from that political control which is the most compelling reason against force account work under elected officers.

For all these reasons—and because the government must be able to shift its levee building forces at short notice—it is desirable that the government do a considerable amount of the work with its own forces. Certainly to restrict that portion to 25 per cent of the whole would seriously hamper the Commission's control of the river and probably add to the cost of the work. On the other hand the government and the other levee owners need the contractor. For the government to skim the cream of the levee work will force the contractor out of business to the harm of the entire valley. Some work must be given the contractor—enough to make it worth-while business which a number of men will engage in. Just how much will be given him depends as much upon the honest effort of the contractor to make the lowest profitable bid as upon honest government accounting and inspection, and that proper co-operation is not to be had through legislation of any sort.

The Engineer Vindicated

LIGHT IS breaking in reclamation. Dr. Elwood Mead's appointment to the headship of the bureau is one of the happy events of a particularly depressing Washington season. It is the first constructive act of a Secretary of the Interior who for a full year has been disrupting and demoralizing the reclamation organization, to the extent of threatened ruin for the farmer as well as the national interest in the joint enterprise. Dr. Mead's appointment will be welcomed by all parties, by the friends of agriculture and of reclamation as well as by the friends of sound public administration. For one thing, the able and conscientiously handled study which the Committee of Special Advisers on Reclamation has been conducting will have the best chance of finding useful application through the succession of one of its members to the directorship. But more important than this, a lifetime's experience in engineering and agricultural management is brought to bear on the tangled problems that have developed in the past and that are daily being added to. Farseeing and constructive leadership is assured.

Not least of the gratifying features of the appointment, a great technical activity is restored to technical control. The consistent stand of this journal against the policy of turning over the management of a vast engineering enterprise to unskilled hands, and, still worse, to the hands of politicians, is justified by the present event. In that stand the engineering profession was a unit; it steadfastly opposed the degradation of engineers and of the responsibilities of engineering planning and management to the rôle of servants to political intrigue. It is alike to the credit of the profession that it faced the issue squarely and that it won on the issue. For it has won. Engineers have been fighting for a principle, not a personality. No one, least of all Arthur P. Davis himself, has been demanding his replacement, though Dr. Work's friends have been trying hard to show that that was the main purpose of the engineers' campaign. The offensive features of Arthur P. Davis' dismissal remain, but at least a step has been taken toward undoing some of the worst effects of that act—and the engineer has once more been restored to be something more than a "builder of dams and a digger of ditches."

Separate Sludge-Digestion Sewage Plant

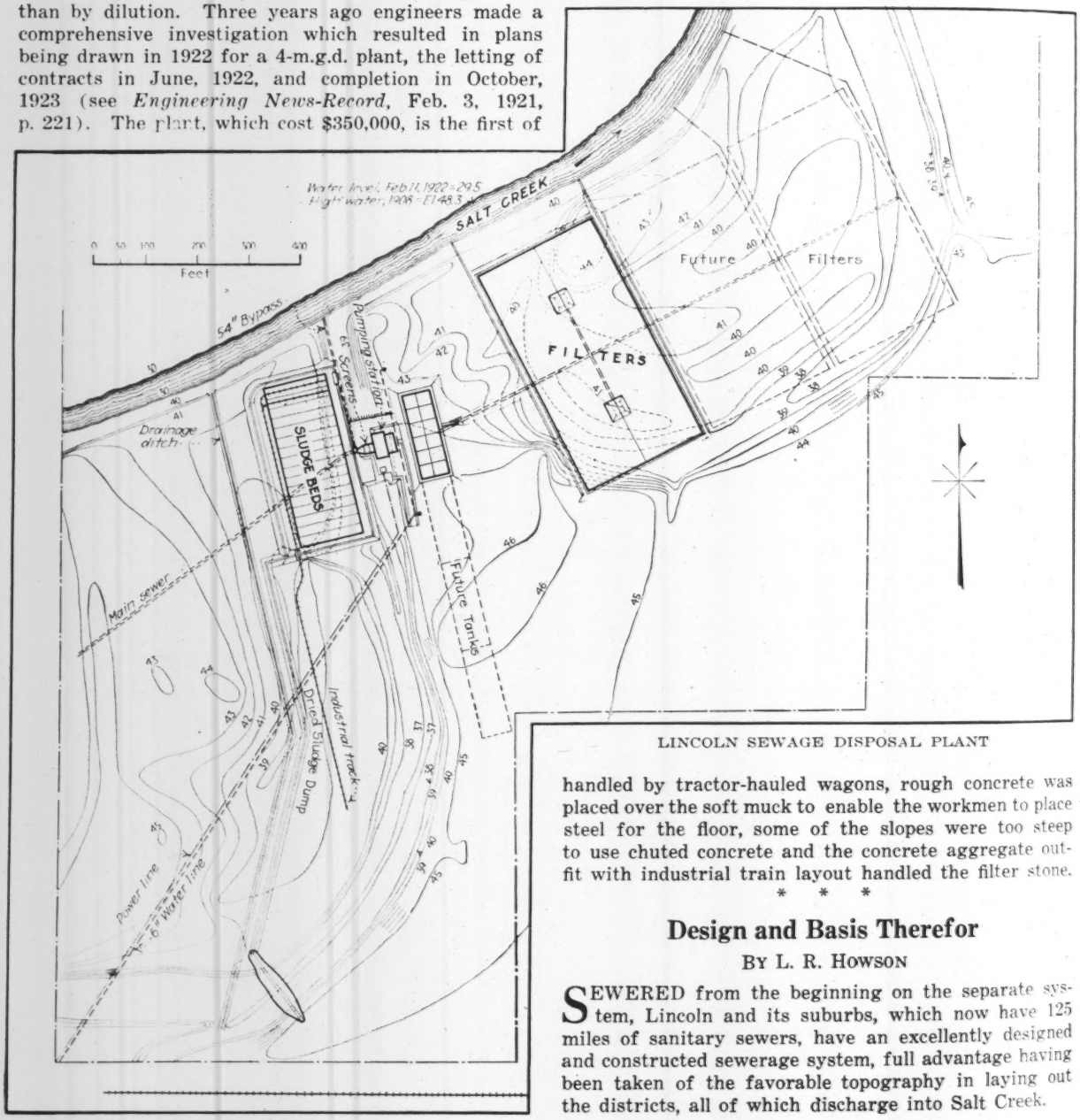
Single-Story Tanks at Lincoln, Neb., Precede Sprinkling Filters in Plant for a Sanitary District—Muck Bottom Covered with Concrete "Raft"—High Pump Efficiencies

BY L. R. HOWSON
Alvord, Burdick & Howson, Engineers, Chicago

AND

H. P. LETTON
Grant, Fulton & Letton, Engineers, Lincoln, Neb.

ONE-STORY sludge separating tanks and sprinkling filters clarify and oxidize the sewage of Lincoln, Neb., and four adjoining towns so it can be turned into Salt Creek without secondary sedimentation. Because Salt Creek is subject to heavy overflow, and in consequence the contiguous broad level valley is not inhabited, the 70,000 people in the Lancaster County Sanitary District have not previously had to treat their sewage other than by dilution. Three years ago engineers made a comprehensive investigation which resulted in plans being drawn in 1922 for a 4-m.g.d. plant, the letting of contracts in June, 1922, and completion in October, 1923 (see *Engineering News-Record*, Feb. 3, 1921, p. 221). The plant, which cost $350,000, is the first of its size and of this type west of the Mississippi. Features of the plant are sludge separating tanks designed on the principle of separate sludge digestion, large suction storage (15 per cent) in the flow line to the plant, flexibility of the pumping equipment, which on test has given unusually high efficiencies, and sprinkling filters in which the stone had to stand tests for alternate freezing and thawing. In construction, excavation was handled by tractor-hauled wagons, rough concrete was placed over the soft muck to enable the workmen to place steel for the floor, some of the slopes were too steep to use chuted concrete and the concrete aggregate outfit with industrial train layout handled the filter stone.



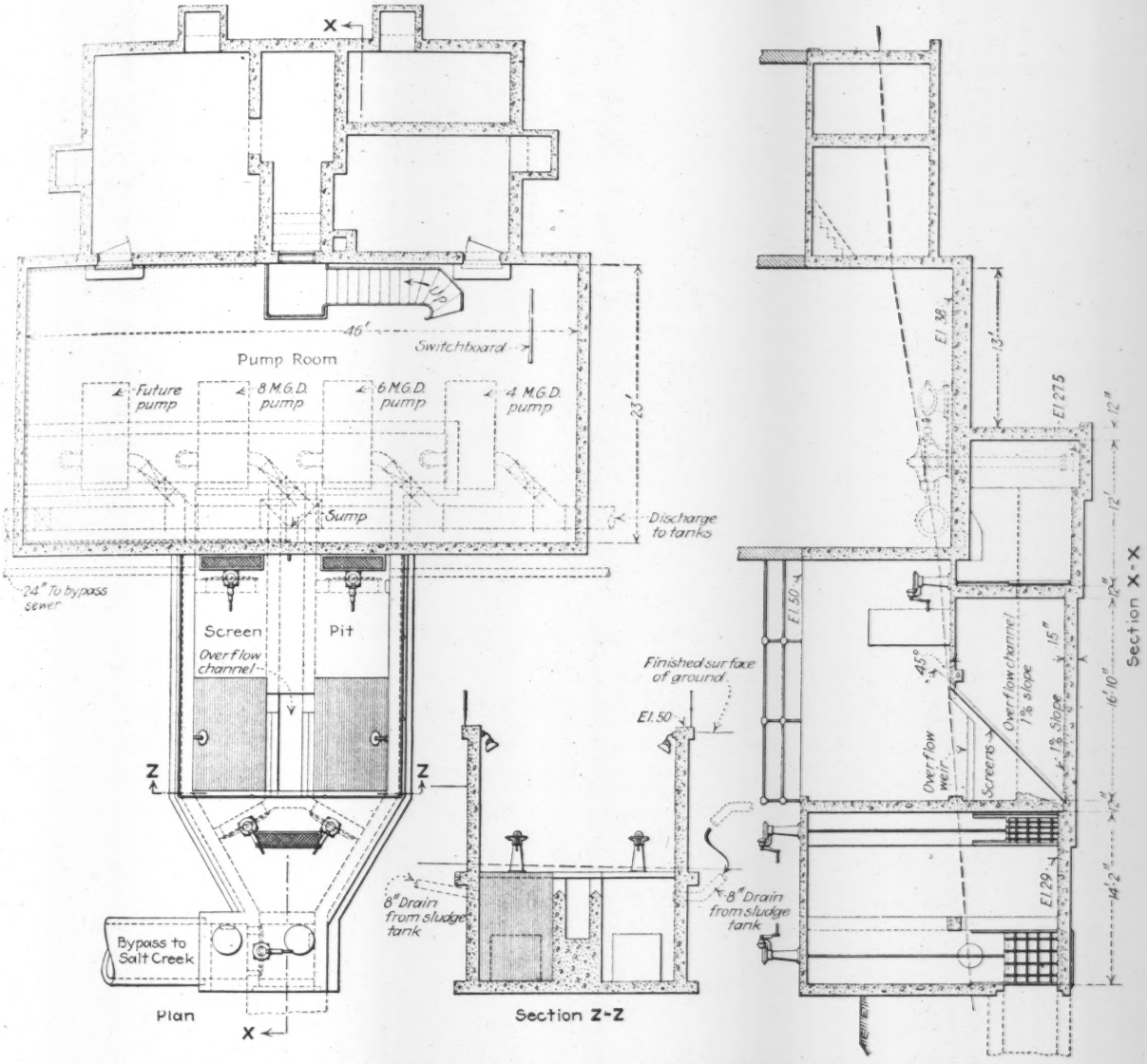
LINCOLN SEWAGE DISPOSAL PLANT

* * *

Design and Basis Therefor

BY L. R. HOWSON

SEWERED from the beginning on the separate system, Lincoln and its suburbs, which now have 125 miles of sanitary sewers, have an excellently designed and constructed sewerage system, full advantage having been taken of the favorable topography in laying out the districts, all of which discharge into Salt Creek.



PUMPING STATION AND SCREEN CHAMBER OF LINCOLN SEWAGE DISPOSAL PLANT

The average annual flow of Salt Creek is sufficient to provide dilution at the present time of from 2 to 3 sec.-ft. per thousand population contributing sewage. The minimum flow, however, provides less than 1 cu.ft. per second per thousand population, and during low flows nuisance has resulted. Though the total population of the district is 70,000 only 50,000 people are connected. The plant is designed for an ultimate load of 80,000 people.

The sewage, which flows to the plant through a 54-in. segment block sewer, is first coarsely screened and then lifted 35 ft. by pumping equipment so that the flow through the remainder of the plant is by gravity. The pumps discharge into the sludge separating tanks from which the effluent flows to two dosing chambers each serving two sprinkling filter beds. The effluent from the beds flows directly to Salt Creek without secondary sedimentation.

As the storage in the 54-in. sewer between normal water level and the sewer flowing full amounts to nearly 15 per cent of the average daily flow, it is sufficient to equalize the hourly variations so that the operation of the pumps and the flow through the subsequent features of the plant may be maintained at a practically uniform hourly rate. A 54-in. bypass is so located that the entire plant can be bypassed if desired.

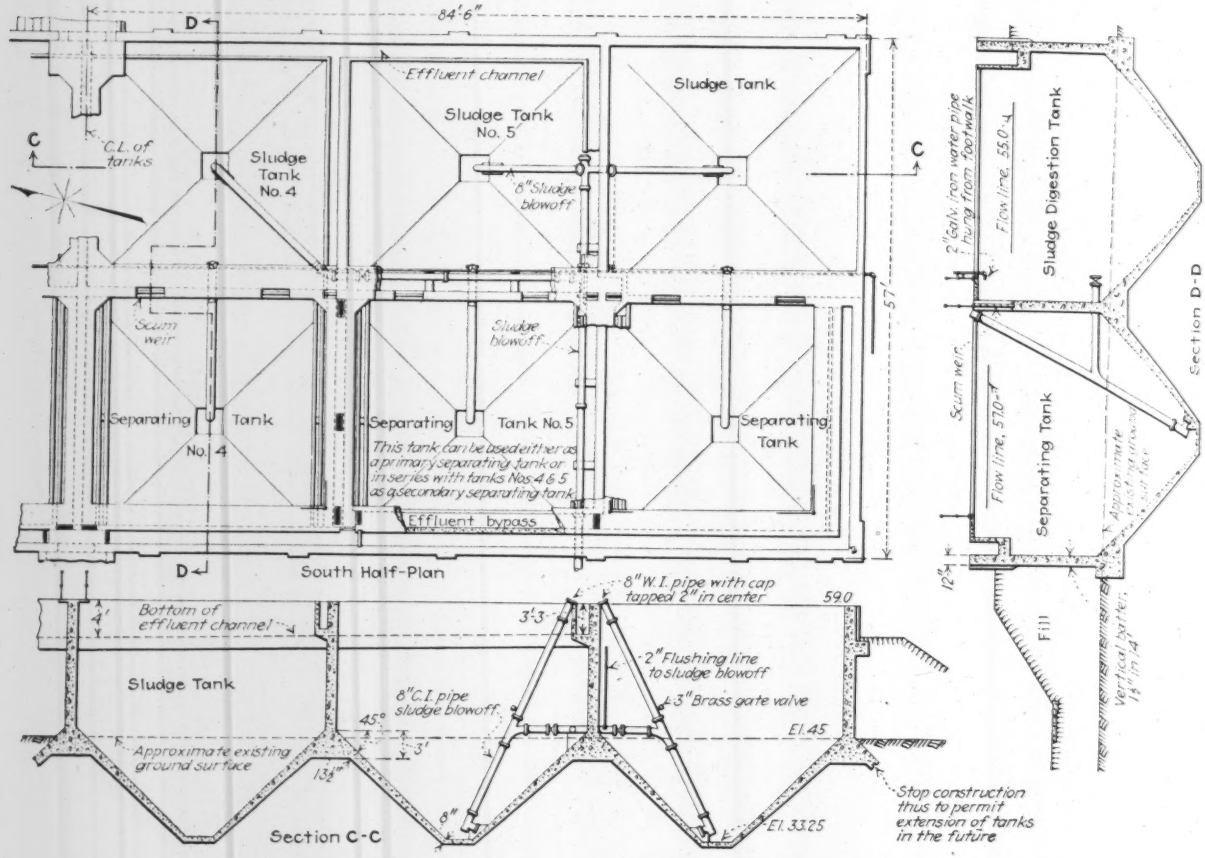
The quantity of sewage to be treated at the present time is approximately 4 m.g.d. but it is estimated that this quantity will increase to 6½ m.g.d. within the next ten years. The sewage is typically domestic and relatively fresh, the maximum time required from origin of sewage to the plant being about five hours.

Screens — There are two coarse rack removable screens, either or both of which can be bypassed for cleaning or repairs. The ¼x2½-in. bars are spaced 2 in. c. to c. and are inclined at an angle of 45 deg. with the horizontal. The velocity through the screens is ¾ ft. per second at the present time and will be 1 ft. per second ten years hence. A concrete deck is provided at the top of the screens to facilitate raking and removal of the material caught on the screens. Float gages have been installed inside the pump room to indicate the elevation

of the sewage and behind the screens, so that the operator may at any time ascertain the amount of clogging. Should the operator neglect to clean the screens an overflow weir is provided for bypassing the sewage.

Pumps—The pumping equipment is of the motor-driven centrifugal type, with three units of 4-, 6- and 8-m.g.d. capacity respectively when operating against a total head of 35 ft. When the sewage heads up on the suction side of the pumps to the top of the inlet sewer capacity of the inlet sewer. All pumps are provided with handholes on the suction side of the impeller to facilitate removal of trash. A 24x12-in. Venturi meter on the pump discharge line makes it possible to keep a continuous chart record of the sewage flow.

Sludge Separating Tanks—The tanks have been designed on the separate sludge-digestion principle, six separating tanks and six sludge-digesting tanks being provided. All tanks are 27x27 ft. in plan with vertical



SEPARATING AND SLUDGE TANKS OF LINCOLN PLANT

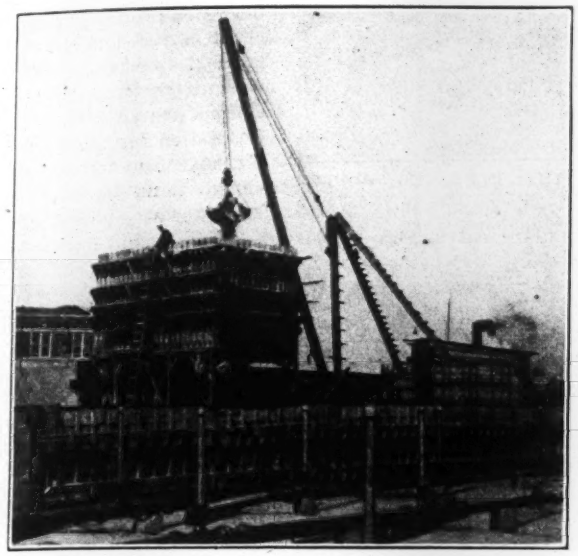
the combined capacity will be about 22 m.g.d. The smallest unit will be sufficient to care for the normal sewage flow at the present time. The selection of the three sizes gives a maximum of flexibility as the pumps may be operated at a 4-, 6-, 8-, 10-, 12-, 14-, or 18-m.g.d. rate under designed head conditions. The combined capacity of all pumps is in excess of the maximum

PRINCIPLE DESIGN DATA, LINCOLN SEWAGE DISPOSAL PLANT

	Condition 1922	Condition 1930
Population served	50,000	80,000
Average sewage flow, m.g.d.	4.0	6.5
Pump cap. each unit, m.g.d.		
No. 1	4.0	4.0
No. 2	6.0	6.0
No. 3	8.0	8.0
Velocity through screens, sec.-ft.	0.75	0.9
Tank retention period, hr. (gross)	3.0	1.9
Tank retention period, hr. (3 ft. scum + 9 ft. sludge)	2.33	1.42
Sludge digestion storage, cu.ft. per capita	1.25	0.78
Dosing tanks		
Dosing interval, min.	30	30
Minutes to discharge	10	18
Sprinkling filters		
Rate per acre, m.g.d.	1.56	2.5
Sludge beds, sq.ft. per capita sewered	0.8	0.5

walls, 14 ft. in height, and with 45 deg. hopper bottoms. Over the tanks is a building with brick walls and a garage type wood truss roof.

The settling tanks are so connected by influent and effluent channels that all units may be used singly as primary tanks, or part of the tanks may be used as primary tanks and the discharge therefrom passed through the remaining tanks acting as secondary tanks in series with the primary. This will enable the plant to operate with maximum flexibility so far as velocity of flow through the tanks is concerned. The designed retention period in the tanks is slightly less than 2 hours, but if the tanks should accumulate a 9-ft. depth of sludge in the hoppers and 3 ft. of floating scum the retention period would be reduced to 1½ hours. Tank influent and effluent control is by stoplogs. Floating scum may be drawn from the settling tanks through stoplog openings directly to the adjacent sludge-digestion tanks. Sludge will be removed from the bottom of the hoppers through 8-in. sludge pipes leading to the adjacent sludge-digestion tanks. Water pressure



AGGREGATE PLANT FOR HANDLING CRUSHED STONE
Storage bins used at concrete plant were moved alongside filters and utilized to expedite handling of filter stone which amounted to half of contract. Filter piping and forms of filter wall in foreground and tank building in background.

may be applied to the sludge-outlet pipes in case of stoppage, or the pipes may be rodded out through the extension of the 8-in. sludge pipe to the top of the tank.

Digestion Tanks—Sludge-digestion capacity equivalent to ¾ cu.ft. per capita is provided in separate tanks which are practically duplicates of the separating tanks. Provision is made to return the liquid resulting from the digestion of the sludge of the pump-suction chamber by gravity. This liquid passes through the plant again with the incoming sewage.

Dosing—The clarified sewage from the tanks flows through a concrete conduit to two dosing chambers each serving two stone filters. Four 24-in. siphons are installed in dosing chambers so designed as to give uniform rates of sewage application to the stone surface with varying heads on the nozzles.

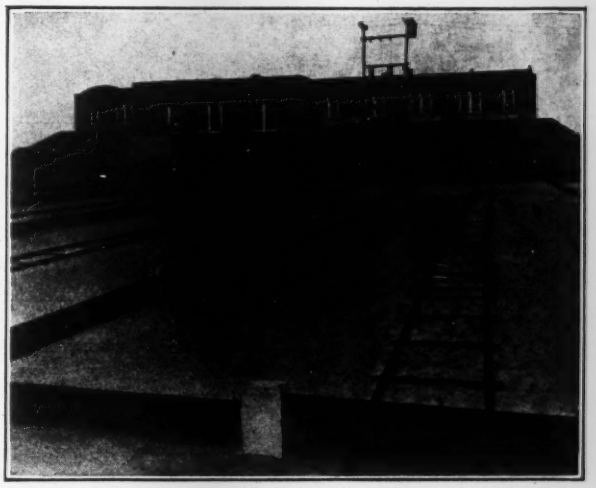
Sprinkling Filters—Four filter beds are built at this time with a total area of 2.6 acres. The depth of bed is 6 ft., the lower 5 ft. being of stone varying in size from ¾ to 1½ in., and the top 1 ft. being of stone from ½ to 1 in. in size. On account of the general inability of the Nebraska limestones to withstand sprinkling filter severe service conditions, an investigation of the local stone quarries was made (see *Engineering News-Record*, Nov. 30, 1922, p. 938). Samples were subjected to alternate freezing by refrigeration and thawing in order to observe the behavior of the stone under Nebraska winter conditions in sprinkling filter use. As a result of these tests it was concluded that none of the Nebraska limestones would be satisfactory and South Dakota quartzite was obtained.

The distribution system is of cast-iron pipe varying in size from 8 to 24 in. The pipe will be laid in the stone bed, but supported by concrete piers. Provision is made for flushing the distribution system through 12-in. blowoff connections. Risers are 3-in. wrought-iron pipe with reducers for the nozzles. Nozzles are of the Worcester circular lock-spindle type. The distribution system is laid out with nozzles at 16-ft. spacings on an equilateral triangle plan. This will produce an overlapping of sprays at maximum heads.

The concrete bottom of the filters drains to channels built in the concrete on 14-ft. centers. Channels are covered with concrete slabs supported to permit entrance of sewage to the channels. The pitch of the floor toward the channels is 1 in. per foot. The valley is filled with stone varying in size from 3 to 4 in.

Sludge Beds—Sludge beds are provided to the extent of about 0.8 sq.ft. per capita at the present time or slightly in excess of ½ sq.ft. per capita under the 1930 conditions. The sixteen sludge beds, 26x125 ft. in plan, are 12 in. in depth with the bottom 10 in. of bank-run gravel and a top 2 in. of fine sand. Removal of sludge is by 24-in. gage 12-lb. rail industrial track laid on steel ties. Influent to the beds is controlled by stop boards and the flow to the bed is over a concrete apron. Underdrainage is provided by 6-in. vitrified tile laid with open joints and surrounded by screened gravel. The excavation is graded to slope to the underdrains which are located on 20-ft. centers. Adjacent beds are separated above the surface by 2-in. planks set in grooved concrete posts set on 12½-ft. centers.

Flood Protection—The valley of Salt Creek is subject to occasional large floods, the maximum flood height recorded having been at El. 48 Lincoln datum. The



SLUDGE BED, PUMPING STATION AND TANK HOUSE
Screen chamber is in concrete chamber surmounted by valve stems

pumping station and tanks are so built as to be safe against floods 2 ft. higher than have been recorded to date.

It was not deemed necessary or economically advisable, however, to protect the stone filters and sludge beds against the extreme floods, tops of the former being 3 ft. below the maximum flood of record. The sludge beds are protected by a berm at El. 45. In order that the berm may not be washed out by overtopping, a concrete overflow spillway is provided for filling the beds before overtopping occurs. With receding water levels the beds will be drained by a conduit protected by a flap gate through the berm.

The original report of 1920 and the plans and specifications for the construction were prepared by Alvord, Burdick & Howson, Chicago, who were also in general charge of the supervision of construction. Grant, Fulton & Letton, Lincoln, Neb., were associated and were

in direct charge of the supervision of construction as well as the making of the surveys and the investigation of the filter stone.

* * *

How the Plant Was Put Together

By H. P. Letton

CONSTRUCTION of the Lincoln sewage treatment plant involved the placing of 5,000 cu.yd. of concrete, together with the erection of two brick buildings, the installation of 375 tons of cast-iron pipe and the placing of 27,600 cu.yd. of crushed stone.

A spur track 3,000 ft. long was built from the Chicago & Northwestern main line to the site of the work, and on this track all material was delivered. A concreting plant was constructed between the settling tanks and the pumping station and the track was run between these structures. The ¾-yd. drum mixer electrically operated was fed by gravity from an elevated

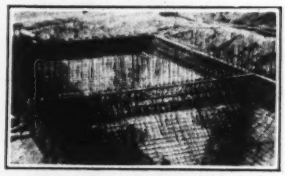
DOSING TANKS IN FILTERS READY FOR STONE

Influent conduit in center supplies laterals leading to nozzles from dosing tank. Concrete drain covers are stacked against distribution pipes.

bin located just south of the mixer. The aggregate, which consisted of a sand-gravel mixture, was unloaded from the cars either directly into the bin or into a storage pile by means of a stiff-leg derrick and clamshell bucket.

Cement was dumped into the mixer by hand, being stored in a cement shed along the west side of the track north of the mixer. The floor of the cement shed was about the same level as the floor of the cars. A runway extended from this shed to the hopper of the mixer. Water from the Lincoln system was obtained from a 6-in. water main which was constructed as part of the project. From an 88-ft. wooden tower equipped with a counterbalanced steel chute the concrete was either deposited directly in place or into another chute section. With this layout it was possible to pour directly the screen chamber and pumping station and the tanks. For constructing the filter, which was located 300 ft. from the tanks, the concrete was discharged from the tower through the chutes into a hopper from which small concrete trucks were filled.

When the excavation for the screen chamber and pumping station had reached a point 3 ft. above the finished bottom, water was encountered. It was then necessary to inclose the excavation completely with wood sheetpiling which was suitably crossbraced. The excavation was then carried to grade, the material being removed in wheelbarrows. Since the bottom was so soft that a man would sink to his knees, the material was taken out to a point 3 in. below grade and then filled with 1:6 concrete. This provided a sort of raft



STEEL IN PLACE IN HOPPER BOTTOM TANKS

on which reinforcing steel could be laid and the finished floor poured.

Tank Bottoms—Specifications required that the excavation for the hopper bottoms of the settling and sludge tanks be done by hand to true planes and that the earth then be plastered with cement mortar to prevent dirt being mixed with the concrete. The bottoms were excavated as required, the material being removed in ½-yd. dump buckets operated from a small guyed derrick, the power being supplied by a hoist driven by a gasoline engine. When the excavation of a bottom was completed the sides were plastered with a 1:5 cement mortar. The mortar was mixed in a small mixer, driven by a gas engine, and was wheeled in barrows to the top of the slopes. It was then shoveled out and allowed to run down the sides and was spread out with plasterer's trowels, working from the bottom to the top. After the mortar had thoroughly set the reinforcing steel was placed. The first bottom was poured by using the tower and chute but it was found that because of the steepness of the slopes, 45 deg., a mixture which would slide in the chute would not stand on the slope. Accordingly, this method was abandoned, runways were constructed and the concrete was mixed in a separate mixer and deposited from carts. In this way it was possible to finish the slopes to grade and get a smooth surface.

The floor of the filter consisted of ridges 14 ft. apart with a valley and drain between them. The rough excavation was done with a dragline outfit, the excavated material being deposited into 2-yd. bottom dump wagons, which were drawn in trains of three wagons each by a tractor. On the ridges 2x4-in. guides were set to line and grade and on these guides wooden templets shaped to fit the finished grade were slid. The trenches for the drains were excavated and inside forms set by templets from the guides at the ridges. As fast as the floor was troweled the guides were removed and the space occupied by them was filled with concrete and troweled. With the small truck hauling concrete, it was possible to lay 600 sq.yd. of floor in 10 hours.

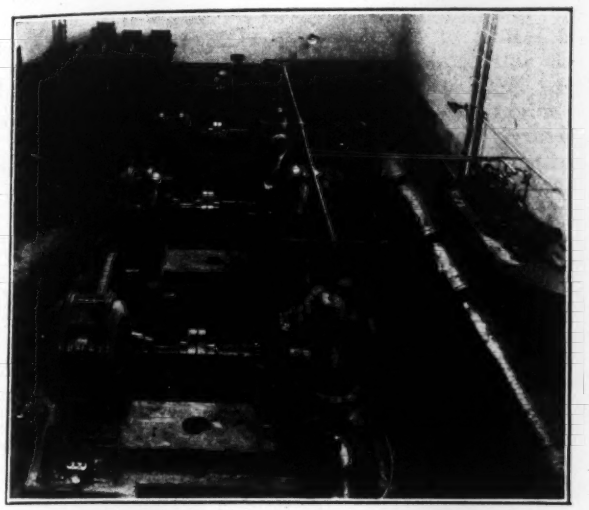
Wood forms wired together were used generally on the work. At the start bolts were used but they were not found as satisfactory as simple wiring. Two of the tanks, the pump room and one wall of the filter were constructed with sectional steel forms. The steel forms gave a smooth, attractive finish but they did not seem suitable for use with chutes as the rapid deposition of concrete would knock them out of line. Forms for pouring the precast drain covers, pipe supports and sludge bed posts were constructed on the job. They were so built that the sides could

CORNER OF HOPPER BOTTOM TANK

Expanded metal takes negative stresses.

be dropped and the molded concrete removed after setting 24 hr. The forms were then piled and re-used. All the cast-iron pipe was joined with leadite which effected a considerable saving in cost. The cuts, of which there were hundreds, were all made by hand with a cutting chisel.

The dosing tanks were not constructed until the filter floor was in place. The aggregate was hauled to a pile near the dosing tank and the concrete was mixed with a small mixer and elevated to the tank with the derrick



FOUR- SIX- AND EIGHT-M.G.D. PUMP UNITS
Extreme flexibility in capacity without sacrificing efficiency obtained by variable size of units. Discharge at right and switch board in left background alongside Venturi meter recorder.

and bucket used in excavating the hopper bottoms for the settling and sludge tanks.

As a considerable portion of the work was done under winter conditions, a grid of perforated pipe was placed in the bottom of the sand-gravel bin and steam was fed through these pipes from the hoisting engine boiler. The water was also heated and the concrete leaving the mixer had a temperature of from 60 to 90 deg. F. Tarpaulins were placed over the forms with

GUARANTEED CAPACITIES AND TEST EFFICIENCIES OF SEWAGE PUMPS, LINCOLN, NEB.

4 M.G.D. Pump

	Guarantee	Test	Guarantee	Test
Capacity, g.p.m.	2,800	3,160	3,750	4,000
Total head, ft.	35	35.41	25	27.6
Pump efficiency, per cent	76	79.2	69	78.5
Overall efficiency, per cent	67.5	72.8	61.4	69.8

6 M.G.D. Pump

	Guarantee	Test	Guarantee	Test
Capacity, g.p.m.	4,200	5,200	5,775	5,975
Total head, ft.	35	34.62	25	27.1
Pump efficiency, per cent	77	84.7	70	75.0
Overall efficiency, per cent	68.5	75.8	62.6	67.2

8 M.G.D. Pump

	Guarantee	Test	Guarantee	Test
Capacity, g.p.m.	5,600	6,700	7,700	7,650
Total head, ft.	35	35.24	25	29.1
Pump efficiency, per cent	78.0	79.0	71.9	73.3
Overall efficiency, per cent	70.5	71.5	64.25	66.3

salamanders inside and outside and no trouble was experienced with frozen concrete.

About half of the total cost of the work was for the crushed stone in the filter. This did not begin to arrive until after all concrete work had been finished. The stiff-leg derrick and clamshell bucket used for unloading concrete aggregate was moved to a point near the center of the west side of the filters and a stone storage bin capable of holding three cars of stone was constructed. With this layout it was possible to unload six cars per day. From the bins the stone was discharged by gravity through chutes into 1-yd. dump cars running on a 24-in. industrial track. These cars were pushed by hand to the filter and dumped. As the fill progressed the track was shifted. The fill was maintained at a height 1 ft. below the top of the filter walls or at the top of the medium-sized rock. The large rock filling the valleys was dumped on board platforms and spread by hand. A separate track was maintained for handling the top layer of small rock, and this was shifted as the fill was made. By the use of two dump cars it was possible to place an average of six cars of stone per day.

The pumps, which were of the double-suction centrifugal type, were purchased under guaranteed capacities and efficiencies. When the installation was completed, accurate tests were run and the figures shown in the table were obtained. Efficiencies obtained from these units are believed to be higher than for any other sewage pumps now in use. The pumps are designed to pass solids up to 1¾-in. diameter and are equipped with handholes on the suction sides to allow for inspection and cleaning.

The general contractor on all the work except for the pumps was A. Phelps & Sons of Knoxville, Ia. The pumps, made by the Aurora Pump Co., were sold and installed by the Kent Engineering Co., Omaha.

Road Maintenance Costs in Minnesota

Extract from a paper read at the annual meeting of The Minnesota Surveyors & Engineers Society by W. F. Rosenwald, maintenance engineer, Minnesota Highway Department.

SOME outstanding figures taken from the cost analysis of the maintenance expenditures on the trunk highway system during the past year are of interest. The expenditures on dirt roads averaged $375.16 per mile, of which 73 per cent was for maintenance proper, 16.1 per cent for betterments, 5.7 per cent for special work such as marking, and 5.2 per cent for overhead and supervision. The highest cost per mile was $1,496.45 on a road which was practically entirely reconstructed and 75 per cent of this figure actually represents a betterment. On graveled roads, the expenditures averaged $540.97 per mile on the older and $538.46 per mile on the more recent roads. Of these amounts 83.6 per cent was for maintenance proper, 5.2 per cent for betterments, 6 per cent for special work, and 5.2 per cent for overhead and supervision. The highest cost per mile on any one graveled road was $2,745.17, practically all of which can be classed as maintenance proper.

On concrete roads, we find a wide variation between those repairs made during the first year after construction and those made on older pavements. The average per mile on first-year pavements was $360.55, whereas on the older pavements it was $169.55. The difference is found to be almost entirely for repairs on the newly constructed shoulders. Of the expenditures, 9 per cent was for maintenance of the slab proper, 64.6 per cent for shoulder and drainage maintenance, 4.0 per cent for betterments, 16.5 per cent for special work and 5.9 per cent for overhead and supervision. Patches and filling cracks account for $32.40 per mile. Repairs to shoulders, $243 per mile on the new roads and $65 on the older roads. Work on structures accounts for $25.30 and $13.30 respectively. The balance comes under special work, the largest item of which was $25.30 for snow-drift prevention, and $16.20 for markers, signs and warning signals.

Structure and Facilities of a Modern Hospital

Wisconsin State Institution at Madison Has Concrete Frame with Slab and Joist Floors—Wood, Tile and Concrete Flooring—Natural Ventilation with Windows of Transom Type—Piping Arrangements

By Arthur Peabody
State Architect, Madison, Wis.

FEATURES of interest to the architect and engineer as well as to the medical fraternity are included in the design, arrangement and construction of the State General Hospital, now being built at the University of Wisconsin, at Madison. This building, designed to accommodate 300 patients, is the central unit of a hospital group, of which the only other buildings as yet erected are the Bradley memorial hospital for children and the

FIG. 1—ARCHITECT'S PERSPECTIVE OF WISCONSIN STATE GENERAL HOSPITAL AT MADISON

infirmary for students at the university. The site for the General Hospital is about 600x400 ft., with a frontage of 600 ft. on University Ave. The architectural design of the building and a typical floor plan, with interior arrangement, are given in Figs. 1 and 3.

General Arrangement—The hospital is 320 ft. long, with a wing at each end and a service wing on the north side (see Fig. 3). The building is six stories high, and a portion of the roof is utilized as a roof garden and children's playground. With the first floor practically at the ground level, instead of an ordinary basement there is a cellar entirely underground. This cellar, containing the mechanical equipment and dark storage extends under the main portion and east wing, but experience shows that it would have been wise to include the entire area of the building. A basement under the north wing, lighted by area windows, contains the refrigerating apparatus and service rooms.

In the main building and end wings the stories are assigned as follows: first, concourse and clinic; second, psychiatry; third, obstetrics and private rooms; fourth, general medicines; fifth, orthopedics, and eye, ear, nose and throat cases; sixth, general surgery. In the service wing the kitchens occupy the first floor; second, dining rooms; third, laboratories; fourth, laboratories and library; fifth, internes; sixth, operating suite; seventh, solarium. The east and west wings terminate in glass enclosed solariums for medical administration of sunlight and fresh air for treatment. In the south or street front of the third story is a large open loggia for the use of convalescents.

Material and Interior Finish—Since a state law provides that all hospitals and places of detention be of fireproof constructions, the walls, floors, roofs, partitions, stairs, elevator shafts and other structural parts of the building are of concrete and steel. In the patients' rooms, however, the floor surfacing is of hardwood. Most of the doors are of wood, having flush panels with inlaid lines, and the window frames are of wood. Metal doors, windows, inside finish and furniture might have been used, but this was not considered necessary. In fact, it was thought that by straining after perfection in fireproofing, sanitation and labor economy, a repellant or depressing character might be given, which might react undesirably upon the patients.

With this consideration in view the concourse, where people come for first examination and where out-patients wait their turns, is treated somewhat like the lobby of a modern hotel. The patients' rooms are also made attractive, while the loggia for convalescents is cheerful with polychromatic terra-cotta and particolored floor.

Design of building—Although the general plan must be determined first, the architectural design must follow closely or go hand in hand with it. Since the structure is to be the center of the medical group there was every reason that the architectural treatment should be well executed, but designed with a view to the use of the building and reasonable limitation of expense. The style is a free Italian renaissance, carried out in buff vitreous brick and gray stone. As the building is visible from all sides, there was little opportunity for modification of treatment for parts ordinarily obscured.

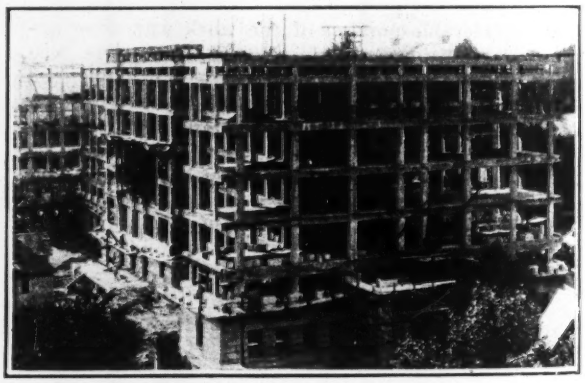


FIG. 2—CONSTRUCTION OF CONCRETE HOSPITAL: JULY 5, 1923
Note two-story steel columns in front wall. These will be enclosed by stone pillars in the open front of loggia in third floor.

This condition necessitated some restraint in the treatment of the principal front, in order that the major elements of the design could be extended around the building without excessive cost. It is the belief of the architect that with the sympathetic and efficient collaboration of the engineers in the design the building will fulfill the three attributes of excellence: "firmness," including safety and endurance; "convenience" and "delight"—this last including dignity, good appearance and evident worth.

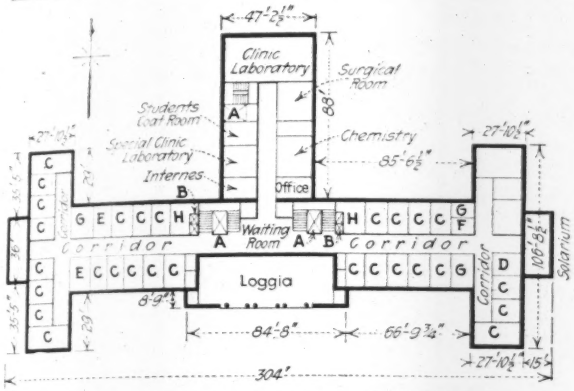


FIG. 3—THIRD-FLOOR PLAN OF HOSPITAL

A, elevators. B, dumb-waiters. C, wards and patients' rooms. D, doctors' room. E, toilet rooms. F, service room. G, rooms for sterilizing utensils. H, service kitchens.

Structural Design—Originally a wall-bearing type of construction was proposed but to expedite construction and at the request of the contractor this was changed to a complete concrete frame. When the contracts were executed in August, 1922, the congested state of the stone business prevented securing cut stone at a reasonable price and the proposition of the contractor to make the change in design without increase in cost was accepted. This change involved re-designing, resulting in some loss of time; whether there will be a financial benefit in the long run remains to be seen. However, the concrete frame type of structure enables a considerable amount of work to be done before the exterior casing is undertaken. Besides, wall-bearing buildings of six stories or more require such thick walls that the concrete frame gives a certain gain in floor space.

Typical construction is shown by Figs. 4 and 6. In general the columns are spaced to form bays or panels 11x17 ft. Floors are of the ribbed slab type, with girders between the columns and are designed for a live-load of 60 lb. per square foot. Interior partitions are of gypsum tile. The roof slab is covered with concrete pavement in the parts used for recreation and playground, and with tar and gravel roofing on other parts. The heights of the stories are 10½ ft. from floor to ceiling. In Fig. 2, which shows the building under construction in July, 1923, steel columns will be noted in the central part of the main front. These structural columns are two stories high, in the open front of the loggia; they are cased in stone to represent masonry columns harmonizing with the general design. Their location is indicated also in Figs. 4 and 6.

Floor Surfaces—After consideration of the life, suitability and cost of various forms of composition floors, it appeared that marble-mosaic terrazzo was the most advantageous for corridors, public rooms kitchens and dining rooms, stairs and landings. In color there will be a mixture of white, green, buff and black, with white predominating. Hardwood flooring will be used in the patients rooms, as it is pleasant and durable, while cement or terrazzo is too institutional in appearance. It has been claimed, that the wood floors are not sanitary, the cracks being full of dirt. But there are practically no cracks when the floor is laid and if the floor is not scrubbed there will be no serious cracks. Good hardwood floors should not be scrubbed; they deserve better treatment and an oil mop will be as efficient as a wet mop. Even for occasional soiling, wet mopping should not be employed, as it injures the wood and causes cracks from which no scrubbing will remove the accumulation of dirt. Walls and ceilings are finished with paint.

Pipes and Wiring—In the cellar are located the numerous main pipes for steam, hot and cold water, fire service, fuel gas and compressed air, as well as the electric conduits for light and power. Here also are the main switchboard, pumps, tanks, heaters, water softeners and mattress sterilizers. Throughout the building the pipes and conduits are hung below the concrete slab and above the ceilings, instead of being embedded in the floor. The extra cost of this arrangement is justified by the facility for repairs and changes. Several changes have been made already and still others will be desirable.

Vertical piping is arranged generally in the partitions, but where this is not practicable the piping is placed in wall channels. No water pipes are placed in exterior walls, owing to the severe winter climate. Risers of the heating system are exposed in the rooms. This is somewhat unsightly, but the advantage of flexi-

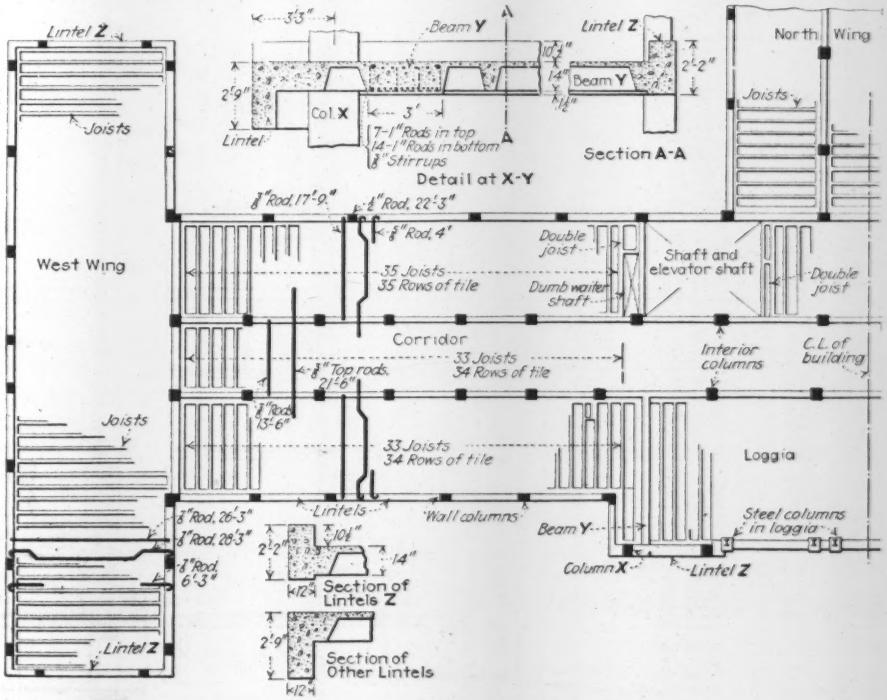


FIG. 4—FRAMING PLAN OF THIRD FLOOR

bility taking up expansion and contraction movements appears to outweigh aesthetic considerations.

Heating — A hot-water heating system is used, the water being heated by steam from the central heating plant of the university. From the heaters the water travels to the attic above the top floor, where it is distributed into feeders descending through the stories and connected to radiators, the water returning eventually to the heaters in the cellar. A recent invention enables high-pressure steam to be injected directly into the water without noise and under perfect control, so that the temperature of the water can be adjusted to weather conditions.

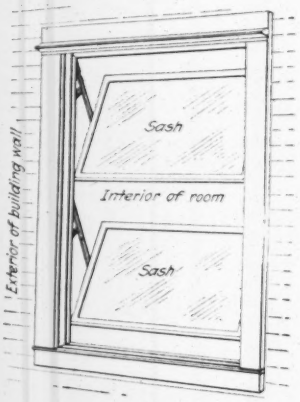


FIG. 5—WINDOWS OF TRANSOM TYPE

Natural Ventilation—It is of special interest to note that the ventilation system is based on the open window. This may appear a rather radical departure in a severe climate like that of Madison, but there is no doubt of its efficiency, since it has been used in the infirmary and the Bradley memorial hospital since 1918. This system provides fresh air of normal humidity; it eliminates all consideration of periodical changes of air and it does away with motors, fans, ducts and vents. In the private patients' rooms the only limit is the personal preference of the patient, subject to modification by the physician and nurse. It is found that the windows are open practically all the time and that rooms are ordinarily rather cool than otherwise. In fact, experience indicates that these rooms do not generally require a temperature of more than 70 deg.

Ventilation in wards depends also on the open window. These wards are small, sixteen beds being the maximum, and the windows are frequent and large. Mechanical ventilation on either the blast or the exhaust system, as required, is provided for toilet rooms, interior rooms, kitchens, laboratories and class rooms.

Special Window Design—With natural ventilation, the window construction must be arranged, of course, to admit air without causing drafts. For this reason each window in the private rooms is of the Simplex transom type and consists of transverse panels pivoted in the side frames and swinging inward, as shown in Fig. 5. These panels are attached to levers and can be adjusted to give an opening from one to six inches wide, the air flowing upward and diffusing itself through the room so that no direct draft can strike the patient in bed or a person sitting near the window. In summer the panels can be opened wider, giving nearly 100 per cent of opening. These windows are easily operated and will not be blown open by heavy winds, but in winter they need weather strips to prevent excessive leakage. Fly screens and shades can be applied. Ordinarily windows of this type have the panels swinging outward, beyond the face of the building, and this hospital may be the first building in which the panels were arranged to swing inward.

Windows in other parts of the building are of

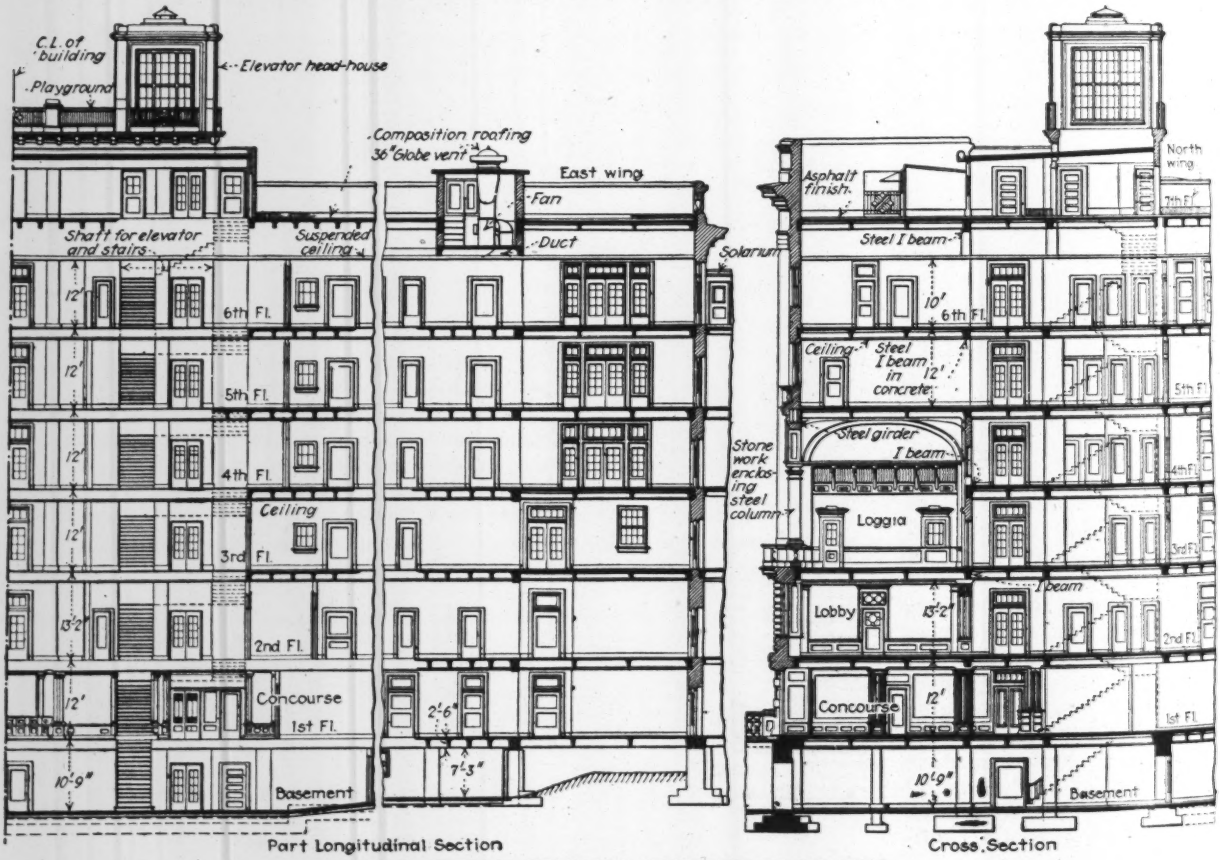


FIG. 6—TYPICAL SECTIONS OF HOSPITAL BUILDING

ordinary sliding type, and those of the solariums have multiple sashes. They are all well built and well fitted, but no special pains are taken to prevent ordinary wind leakage, as fresh air is a necessity. Nor is the waste of heat serious, for there is little difference between the cost of heating by radiators a room having moderately leaky windows and that of blowing preheated air into the room. In the first case the air is heated in detail, while in the second case it is heated wholesale by costly apparatus. Large windows of wired plate glass are used in the operating rooms, the windows being double, with radiators between them to prevent frosting. This detail is shown in Fig. 7.

Water Supply, Sewerage and Waste—The city's supply of water from wells is used for drinking and domestic purposes since it is safe from infection. But this water is hard and for hot-water service it is treated by a softening process to prevent the incrustation of pipes and heaters. For toilets and fire protection the university pumping station furnishes a supply from Lake Mendota, but this water is not safe for drinking and is not desirable for hot water as it gives off weedy odors.

Sewage is discharged into the city's sanitary sewers, and stormwater is delivered into separate sewers discharging into the lake. Ordinary waste paper and clean waste is removed by the cleaning force of the university. Garbage is removed by the city. For surgical waste and other material that needs to be destroyed, there is an incinerator of the gas burning type, located in the service wing. Laundry work will be done by the central laundry of the university.

Electric Service—All current for the hospital is furnished from the university substation which is supplied by a transmission line from the hydro-electric plant at Sauk City. Since occasional interruptions which are caused by storms might be very serious in a hospital, as in causing stalling of elevators or interrrupting surgical operations, a standby or emergency source of supply will be provided. Whether this will consist of a steam plant in the substation or of storage batteries charged by a motor-generator set and put into service automatically upon failure of the regular supply, has not been determined.

The general lighting system presents no unusual features, but there are special lighting fixtures and special lighting systems in the operating rooms. Electric power is used for the elevators, X-ray apparatus and other medical purposes; also for baking and for operating the refrigerator plant and other equipment.

Signal service includes the nurses' call system, consisting of electric lights located in the halls and operated by bedside cords and push-buttons. Physicians' calls, separately wired to soft-toned gongs, extend from the central station to all parts of the buildings, so that a physician at any point can be notified that his presence is desired. The interior telephone system is connected with the public telephone service.

Kitchens and Dining Rooms—No less than twelve kitchens are required, including the main kitchen in the first story, with main diet kitchen adjacent. Ten diet kitchens located at each side of the central portion of the building prepare and serve the special diets for patients in the wards and private rooms. Separate dining rooms are provided for the physicians, internes, nurses and employees, that of the nurses being arranged as a cafeteria.

Refrigeration—It was proposed at first to have small unit refrigerating plants in each of the ten diet kitchens, but the plan adopted provides for a single plant having capacity for ample refrigerating and for making 1,500 lb. of ice daily.

Transportation—Two electric elevators are placed near the center of the main front and a third in the service wing. These elevators are large enough to take full size hospital cots. For conveying food and other materials there are seven electric dumb-waiters.

Fire Protection—The building is provided with stand-

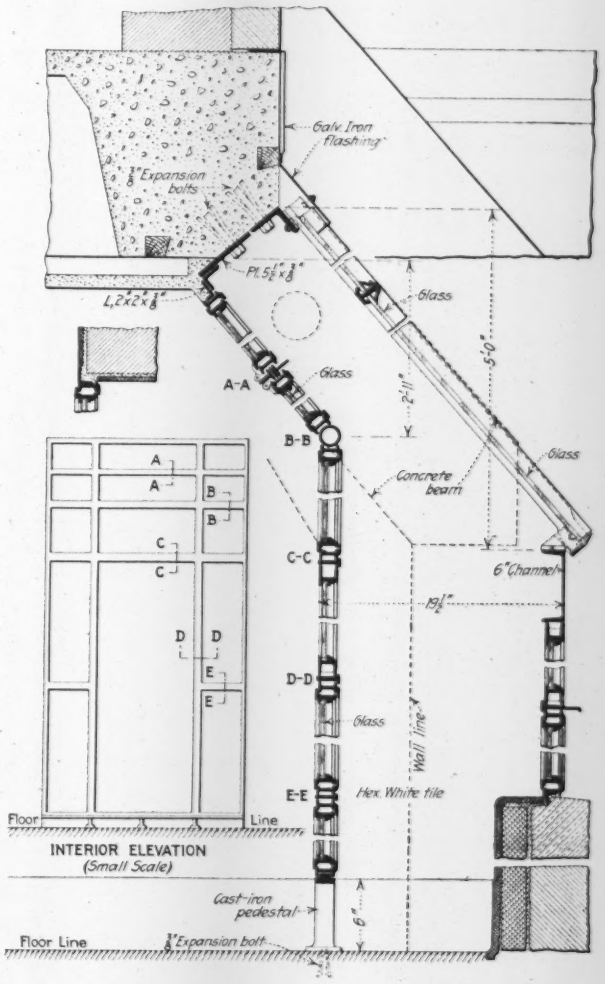


FIG. 7—DOUBLE WINDOWS FOR OPERATING ROOM

pipes and linen hose, in cabinets, besides an equipment of portable extinguishers of the soda acid and carbon tetrachloride type.

Designers and Builders—The hospital was designed by Arthur Peabody, state architect; the structural design and mechanical equipment being handled in the State Department of Engineering under J. G. D. Mack, state engineer until his death, which was noted in these columns recently. The general contractor is the Immel Construction Co., Fond du Lac, Wis. It is expected that the building will be in service by August, 1924, and will cost complete about $1,200,000 including the building, equipments, furniture and fixtures.

Semicircular Wood Flume With Radius of 6 Ft.

Creosoted Staves and Section Giving Minimum Leakage Make for Long Life—Crew Assembles 500 Ft. per Day

THE CENTRAL Oregon Irrigation District recently found it necessary to replace the wooden box flume which carried the main canal along the canyon of the Deschutes River, three miles above the city of Bend, Ore. The box flume, a structure 18 ft. wide, had been in use 18 years, a period far beyond the usual life of this class of construction. As the flume box aged and decayed heavy leakage had rotted the substructure and

SEMICIRCULAR 12-FT. FLUME ALONG THE DESCHUTES RIVER

weakened footings so that only by the most thorough patrol and heavy maintenance was the structure kept in service during recent years. Due to the necessity of supplying water to stock on certain sections in the project, the flume was operated at intervals during the winter season and the heavy accumulation of ice from the leaky box was an additional problem.

In planning the renewal of the flume detailed plans were prepared and bids called for on (1) a semicircular, creosoted wood-stave flume, and (2) a semicircular metal flume. After bids were received and compared the former class of construction was adopted. The total length of flume to be replaced under the plans is 5,820 ft. During the winter and early spring of 1923, 3,920 ft. of the new flume was constructed, leaving 1,900 ft. of flume and reconstruction of the headworks for later attention.

The new semicircular flume is 12 ft. in diameter and the sides extend along the same circular curve to a height of 1 ft. above the diametral line. The depth of water is 6 ft. under the maximum flow and this upper foot, which adds 21 per cent to the area of the cross-section, is considered as freeboard. Due to the necessity of utilizing the headworks and following the location of the old flume, a rather high velocity was used in the semicircular section. The hydraulic properties are: Capacity, 656 sec.-ft.; slope, 2 in 1,000; n., 0.012; wetted perimeter, 18.85; velocity, 11.6 ft. per second.

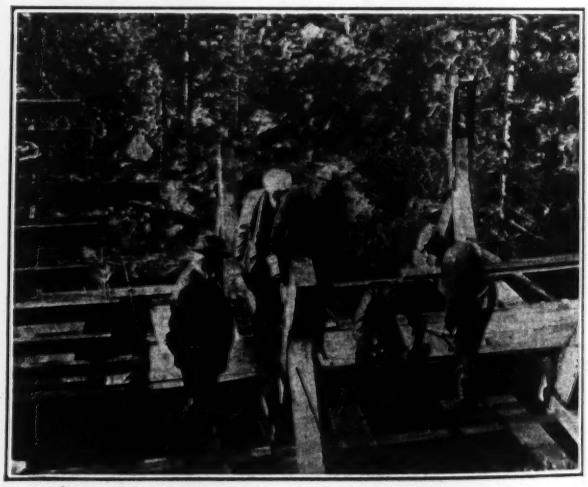
The semicircular section has ideal hydraulic properties and careful attention was given to the curvature of the flume. The result is reported to be an exceptionally smooth flow with a minimum of disturbance even though the critical velocity for the depth of flow is approached.

The flume proper is made of Douglas fir staves of 1⅜-in. finished thickness and about 5½-in. width. The edges of the staves have no bead, being simply beveled to radius. These staves are only about two-thirds the thickness that would be used for a pipe of the same diameter, for the reason that the flume does not involve the arch action which exists in the upper half of a pipe when empty. After being milled the staves were given an 8-lb. pressure treatment of creosote. The staves are made tight by edgewise pressure exerted by ½-in. mild steel rods, spaced 16 in. on centers and passing through the ends of 4x4-in. fir spreaders. The bands have rolled threads and are tightened by nuts and washers resting on top of the spreaders.

The flume is supported independently of the bands by cradles 8 ft. apart cut from fir timber to the exact outside diameter. When the staves were placed, only enough bands were put on to hold the flume proper in shape, the others being added later by crews that worked independently of the driving crew. The final cinching up was done just before the flume was placed in service.

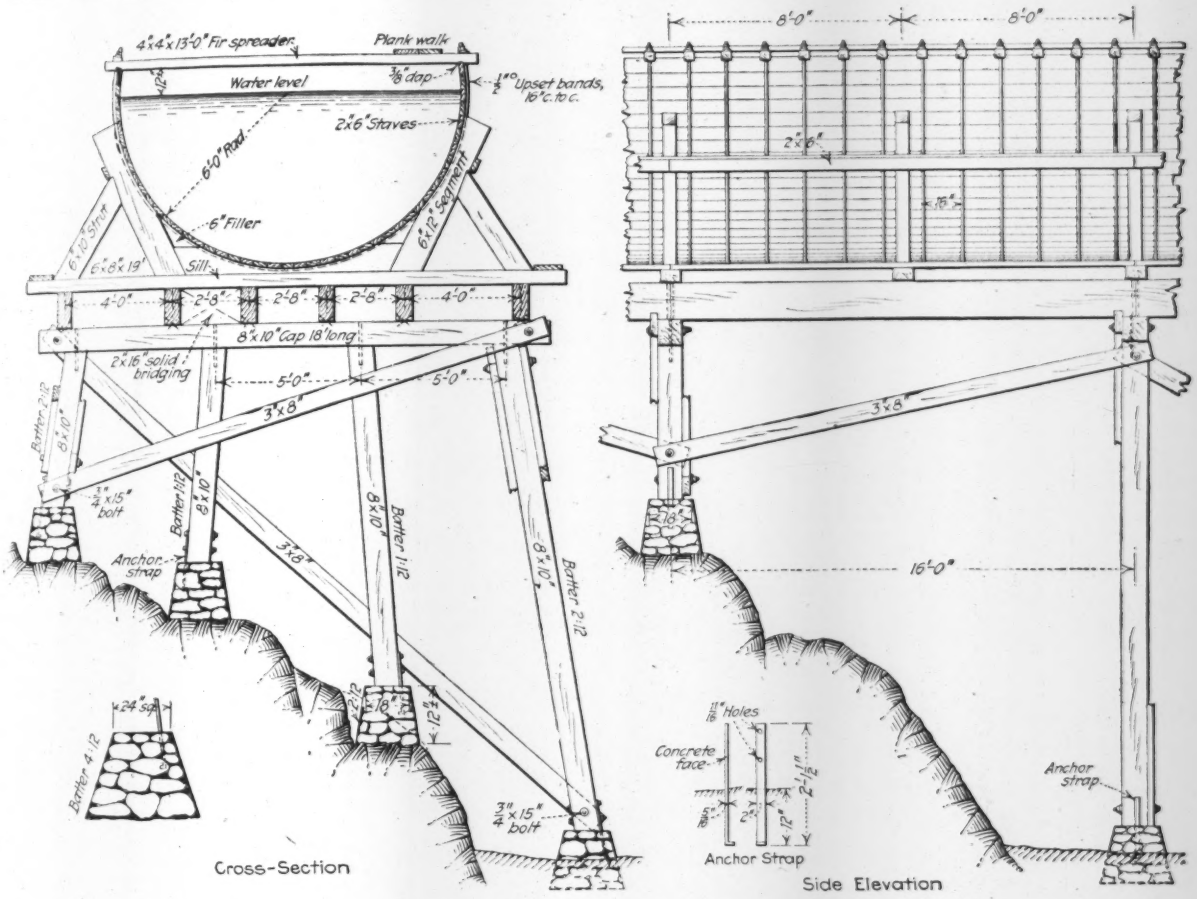
This cinching was done by the most experienced men, the intention being that the expected swelling of the staves would be allowed for without resultant overstressing. After the water was turned in only a few leaks were found and these were readily eliminated by a little adjustment of the band pressure. The flume has now been in service for one full season and is reported to be almost absolutely watertight, a condition favorable to long life of the substructure and preservation of the footings.

In the portion of the flume reconstructed a length



"BUCKLING IN" STAVES WHERE SECTIONS JOIN
Note cradle construction and staggered joints in staves. Bands are laid on each bent ready to be placed.

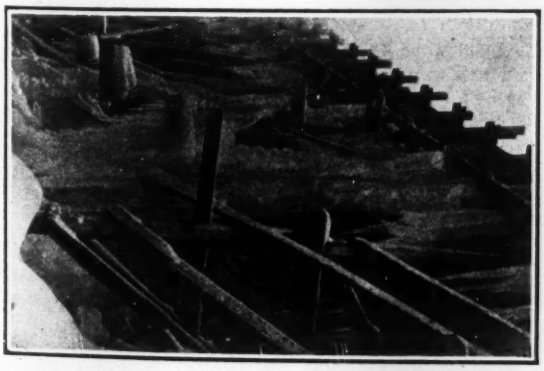
of about 800 ft. of the old flume was eliminated and replaced by a concrete-lined canal. This section is located in a through cut with a maximum depth of 42 ft. The material traversed here is largely pumice,



CROSS-SECTION AND ELEVATION OF SEMICIRCULAR FLUME

having a specific gravity less than that of water. In trimming up the slopes of this cut, the pumice removed was therefore floated out of the cut in the water of the canal.

In general the location follows a steep rocky canyon above the Deschutes River. The fact that the building of the substructure and the erection of the flume had to be done during the winter season when the flume could



ICE LOAD ON OLD FLUME CAUSED BY LEAKS

be kept out of service made the job rather difficult. On account of the availability of rock and the difficulty in bringing in concrete materials, rubble masonry was adopted for the piers. The flume substructure required a total of 340,000 ft. b.m. of Douglas fir. This material and subsequently the staves for the flume proper were delivered on the rim of the canyon at points several hundred feet above the flume, were lowered to the flume through wooden chutes and were subsequently distributed by hand or by means of dollies. The substructure is of standard design and two types: on low portions 8-ft. spans are used without stringers, and on the higher portions of the substructure 16-ft. spans with stringers are adopted.

The construction crew on the flume barrel itself consisted of about twenty men who delivered the material from the chutes, placed the bands and staves, and drove the staves to tightness. After the work was organized this force, divided into two gangs, placed as much as 400 to 500 ft. in an 8-hour shift. As the work was done in two sections, it became necessary in places to join up adjacent sections by "buckling in" or springing the connecting staves into place after they had been accurately cut to the requisite length.

The wrecking of the old flume and building of piers and substructure was done under contract by the Warren Construction Co., Portland, Ore. The flume material, including cradles, was furnished and the erection of the flume barrel was done by the Continental Pipe Manufacturing Co.

Baar & Cunningham, Portland, Ore., were consulting engineers for the district in charge of design and construction.

New Design Expected to Cut Cost of Concrete Roads

Edges Thickened—Edge and Joint Bars Anchored —Longitudinal Joint Doweled—Traffic Line Inlaid—Yardage Reduced

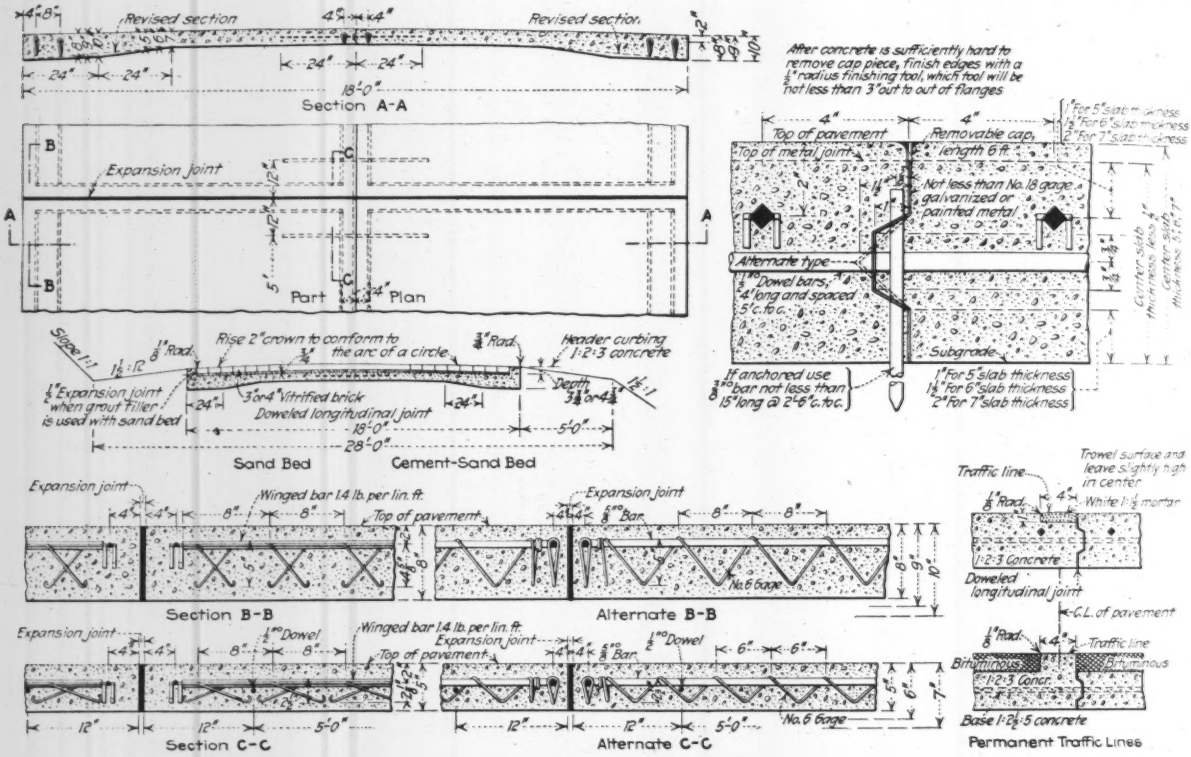
A MATERIAL reduction in the slab yardage and in the weight of reinforcement is provided for in the new Pennsylvania Highway Department design for concrete pavement and pavement base. Based on these smaller volumes the department engineers estimate that the cost of concrete roads should be reduced about $4,000 a mile. At the same time the thickened edges and edge reinforcement will, it is calculated, provide a stronger pavement and the longitudinal joint will prevent center cracking. The new pavement design is illustrated by the drawings. In the case of base the section is lighter and without edge bars.

As indicated by the drawings the original design provided for a uniform thickness in 2 ft. from the edge and then, in 2 ft., a gradual thinning down to the thinner middle-section depth of the slab. This was rather the favored section structurally but the belief of the contractors that an unbroken slope from the edge in 4 ft. would be more simple to construct led to the decision to change future plans as indicated by the broken lines. As the thickened edge slab has been previously used in Illinois (*Engineering News-Record*, Jan. 10, 1924, p. 54) and elsewhere, the edge slopes to the body thickness in 2 ft. Longitudinal, center-joint construction is substantially that of the Illinois pavements of last year and is clearly indicated by the enlarged section.

Except in width of thickened edge zone, the chief structural departure from previous practice is the anchored edge and joint bars. It is considered that this design will add to both stiffness and bond. It will also make the position of the bar more certain. Assembled into units before placing it is considered furthermore that the reinforcement can be quickly installed at a saving in cost over full-slab-width, mesh reinforcement. A number of manufacturers have already worked out units and the outfits for them and methods of assembling them on the work from elements cut and bent at the mill and shipped with clips and chairs.

The minor innovation of design, but one of decided interest, is the permanent traffic lines indicated by the enlarged detail on the accompanying drawing. The specification for this line is:

Traffic line for cement concrete surface courses shall be


Revised section
Revised section
Section A-A
Expansion Joint
Part Plan
After concrete is sufficiently hard to remove cap piece, finish edges with a ½" radius finishing tool, which tool will be not less than 3" out to out of flanges
Top of pavement
Removable cap, length 6 ft.
Top of metal joint
Not less than No. 18 gage galvanized or painted metal
Alternate type
Dowel bars, ¾" ø 4' long and spaced 5' c. to c.
Subgrade
If anchored use ¾" ø bar not less than 15" long @ 2'-6" c. to c.
Slope 1:1
Rise 2" crown to conform to the arc of a circle
Header curbing 1:2:3 concrete
Expansion joint when grout filler is used with sand bed
3" or 4" vitrified brick
Doweled longitudinal joint
Depth 3½" or 4½"
Sand Bed
Cement-Sand Bed
Expansion joint
Winged bar 1.4 lb. per lin. ft.
Top of pavement
Section B-B
Alternate B-B
No. 6 Gage
Traffic line
Trowel surface and leave slightly high in center
White 1:½ mortar
1:2:3 Concrete
Doweled longitudinal joint
C.L. of pavement
Bituminous
Base 1:2½:5 concrete
Permanent Traffic Lines
Section C-C
Alternate C-C

DESIGN DETAILS OF NEW CONCRETE ROAD SECTION FOR PENNSYLVANIA

composed of 1 part white cement and 1½ parts of washed sand, mixed thoroughly to a stiff consistency. It shall be constructed in the center of the width of the pavement on curves and extended on tangents as required. It shall be 4 in. in width and 1 in. in depth unless otherwise specified. The recess for placing this traffic line shall be formed either by placing a strip of wood, 1 in. in depth and 4 in. in width with the edges champfered slightly, in the correct position when the concrete is placed and finished. Where the recess is formed with a wooden strip, the wooden strip shall be cut in segments, not more than 2 ft. in length, and attached with screws to a light metal strip on one edge, so that it will conform to the curvature satisfactorily.

The traffic line shall be constructed from four to twelve hours after the surface of the pavement has been finished, or as soon as the workmen may stand upon the surface of the finished pavement without marring it. After the form has been removed the concrete shall be thoroughly soaked with water, and the white mortar shall be placed in the recess, tamped thoroughly in place and finished with a trowel to the section shown on the drawing. The edges of the traffic lines shall stand up boldly and be rounded slightly as shown on the drawings. The finished traffic line

shall be protected at once with clean wet canvas or burlap and the contractor shall use due care to insure against this traffic line being stained by earth or straw covering or any other foreign substance. The traffic line shall be constructed carefully to the line required and all irregularities shall be corrected before the mortar is allowed to set. Great care must be exercised in the sealing of any joints along or across the traffic line to insure against marring or discoloring the traffic line. In case the contractor permits the traffic line to be discolored in any way, he shall remove such discoloration by rubbing it with a carborundum block or other approved method without additional compensation.

The traffic line for bituminous surface courses shall be constructed 4 in. in width and of a depth equivalent to the full depth of the surface course to be placed adjacent thereto, monolithically with the base course. It shall be true to line and grade and the forms must be cut or bent to conform to the correct curvature on curves. The forms may be in the straight segments 2 ft. or more in length as required by the engineer. The traffic lines shall be protected against damage by hauling, rolling or any other cause, before acceptance of the completed pavement.

Bids received at the first letting of contracts in March ranged from 8c. to 80c. a foot for traffic line construction. For the new section as a whole, prices averaged substantially higher than was anticipated considering the saving in materials. Opinions from contractors who made bids were that the placing of the marking strip would slow up progress, and that subgrade preparation would be more expensive, an opinion not shared by the highway department engineers.

Architects and Engineers Report on Safe Building

Interprofessional Conference Committee Recommends Responsible Supervision and Final Certification by Designer

HOW STRUCTURAL safety in building may be promoted was studied during the past two months by a joint conference committee of architects and engineers representing the professional organizations of the New York metropolitan district, on the initiative of a joint meeting of the two professions held in the rooms of the New York Section, American Society of Civil Engineers, last October. This committee has just issued its report, for criticism and constructive suggestion prior to final discussion and action.

In the view of the committee increased responsibility should be placed on the owner of a building under construction, and at the same time the need for competent direction of building should be met by requiring the designer to supervise the work of construction and carry the whole operation through to completion. When the building is completed, the designer should be required to certify that it has been built properly and safely, and in accordance with the authorized plans and with the requirements of law.

Competent planning and direction of construction are held to be the primary need of safe building, in the committee's report. For this purpose only properly qualified professional men should be permitted to prepare plans for buildings and direct their construction. However "the placing of competent professional men in responsible charge of the planning and execution of building work can only be effective in securing public safety if they are given full authority and do in fact control the work entrusted to them. When clothed with such authority, however, these professional men should carry a corresponding definite and inescapable responsibility."

In order to realize these objects, the committee recommends that a more definite obligation be placed upon the owner, and that the designer be required to direct the construction of the work and at its completion to certify that the building was properly constructed and is safe. The specific recommendations made are:

It is the judgment of this Joint Committee on Structural Safety that a law should be prepared to embody the following requirements, governing the granting of permits and the execution of all building operations.

I. The owner shall be the applicant for the building or construction permit and shall be required to accompany his application for such a permit with the following:

1. Adequate plans and specifications prepared and signed by a competent registered architect or a licensed professional engineer experienced in structural design, hereinafter called the designer.

2: A definite undertaking executed in legal form stipulating that, if the permit is issued to the applicant, he will have all working or shop drawings covering parts and details essential to the stability of the building and required to supplement the plans which accompanied his application, fully checked, approved and signed by the designer; that he will place the execution of the work under the direct supervision and continuous control of the designer; and that he will further undertake, with the co-operation of the designer and by employing only competent contractors and workmen, to perform faithfully the work proposed in strict accordance with the plans and specifications, in compliance with all requirements of law, and with due regard to public safety.

II. Before a certificate of occupancy is issued by a Bureau of Buildings, or by any state or local authorities having jurisdiction, the owner shall furnish to such authorities a duly executed certificate, signed by the designer, stating that he has faithfully supervised the entire work of construction, that it has been executed in accordance with the plans, specifications and working drawings duly signed by him, and that to the best of his knowledge and belief the finished work complies with all the requirements of law and is structurally safe for the use specified.

III. Failure on the part of the owner to comply with any of the above specified requirements shall be regarded as presumptive evidence of a violation of law, constituting a penal offense, and shall be punishable as such.

IV. If at any time after the certificate of the designer has been filed, conclusive evidence is furnished to the state licensing authorities that any statement in such certificate was false and intended to deceive, these authorities shall immediately take the necessary legal steps to have the signer put on trial for perjury, shall forthwith have his name stricken from the list of registered architects or licensed professional engineers, and shall give their action effective publicity.

V. It should be made possible at any time during the process here outlined to substitute a new owner for the original owner, provided that the new ownership is duly recorded on the original papers by affidavit and such new owner assumes all the obligations that would have been his had he signed the original papers. Likewise, a new registered architect or licensed professional engineer having structural experience may be substituted for the original designer of record provided that a like transfer of all obligations shall be recorded on the original papers and these obligations be assumed by the new registered architect or licensed professional engineer as if he had signed the original plans.

The report is signed by six architects, William P. Bannister, George S. Drew, Robert D. Kohn,, Joseph A. McCarroll, D. E. Waid, and C. B. Meyers and nine engineers, F. A. Burdett, J. H. Edwards, J. B. French, Herbert C. Keith, Olin H. Landreth, I. W. McConnell, Wm. Cullen Morris, F. E. Schmitt, and Aubrey Weymouth.

Development of Irrigation in Northwest Canada

Projects by Individuals, Companies and Groups of Farmers—Dry Seasons Promote Third Type—Government Supervision

By P. J. Jennings
Assistant Chief Engineer Reclamation Service, Department of the Interior, Calgary, Canada

ALL IRRIGATION and water-supply development in the northwestern provinces of Canada has been done under laws of the federal or Dominion government, supplemented by those of the provincial governments. A map of the irrigation districts completed and proposed in the province of Alberta is given in Fig. 1 and views of some typical works in Figs. 2 to 4.

Dominion Act—The Northwest Irrigation Act passed by the Dominion government in 1894 provides that the property in and right to use all surface waters in Alberta, Saskatchewan and northern Manitoba shall be vested in the Crown (or government) unless prior right can be established. Rights granted are contingent on beneficial use; when granted for irrigation purposes the water is appurtenant to the land and cannot be transferred, sold or bartered separately. No grants are made in excess of estimated available quantities, which are based on records of stream measurements extending over periods ranging from 10 to 15 years on the main sources of supply (see *Engineering News*, Nov. 14, 1912, p. 906, and Nov. 5, 1914, p. 920). Forfeiture is provided in case of waste or non-usage. Licenses are granted on an acre-foot basis and the maximum rate of diversion is specified for low, high and flood stages.

Grants may be made for domestic, municipal, industrial, irrigation or other uses. A riparian owner has a right under the common law to use as much water as he requires for the purposes mentioned, but he may not divert the water by artificial means unless he obtains authority under the Irrigation Act. In many cases this right is of little value unless the water flowing at high and flood stages in the spring can be stored for use later in the season. Many riparian owners have constructed reservoirs in the belief that they were acting within the law but such impounding is illegal diversion.

A limit is placed on the quantity of water per irrigable acre that may be appropriated. At first the "legal duty of water" was 3 acre-ft. for each irrigation season, but as this was found to be excessive the duty was increased to 2 and finally 1½ acre-ft. The importance of such control is evidenced by the fact that estimated water resources can provide for the irrigation of only 10 per cent of the 50,000,000 acres of irrigable land in Alberta and Saskatchewan.

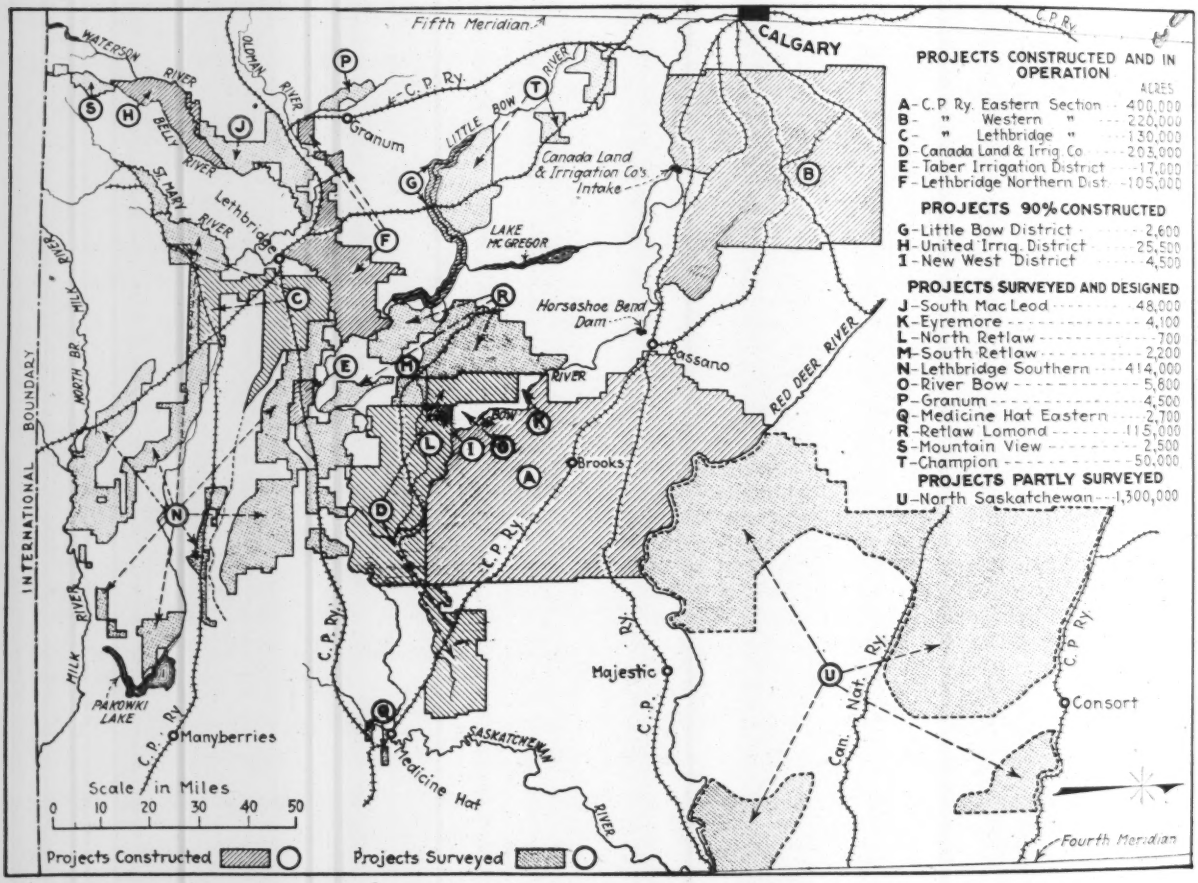


FIG. 1—IRRIGATION DISTRICTS OF NORTHWEST CANADA

Alberta Provincial Act—The part taken by the provincial government of Alberta in connection with the organization, construction and operation of irrigation projects is confined to co-operative undertakings developed under the Irrigation Districts Act of 1920. Most of the present undertakings have had indirect financial

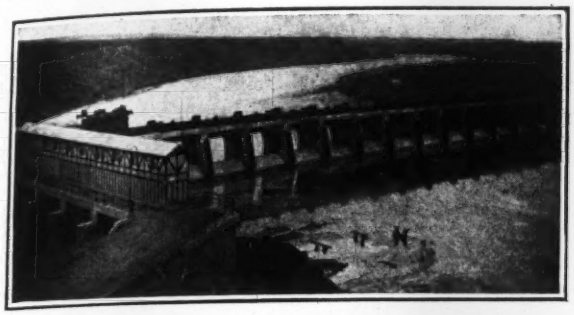


FIG. 2—DAM ON EASTERN SECTION OF C. P. RY. IRRIGATION WORKS

Horseshoe Bend dam and headgate structure near Bassano, Alberta, Canada.

assistance by the province, which has pledged its credit in support of the district bonds. A provincial irrigation council is created, consisting of not more than three members. This council has large power of control, including the expenditure of borrowed money, contract lettings and the fixing of assessments. It may take expert advice at the expense of a district.

A petition signed by the owners of at least 50 per cent of the area of the proposed district must be submitted to the provincial government, accompanied by funds sufficient to pay preliminary expenses and by evidence as to the feasibility of the projects. If this proves acceptable, notice of the petition is published and if no protests are received within two weeks a vote of the interested parties is taken to ascertain whether they desire to proceed. Three trustees are also elected. If two-thirds of the parties favor proceeding, the minister establishes the area as an irrigation district and declares the names of the trustees. The board must meet within thirty days and appoint officers, including an engineer if so directed by the council.

After preparation of the assessment roll and notification of the owners (who may file complaints), the board must comply with the requirements of the federal irrigation act already outlined. Authorization issued under this act reserves the water necessary to serve the lands of the district and is an assurance that the scheme is economically sound. Estimates for the necessary works, preliminary expenses, annual interest on bonds and annual charges for maintenance and operation of the district and the works are then submitted to the irrigation council.

Upon approval of the estimates, the trustees submit to the electors a by-law authorizing the board to raise the necessary funds by a loan, and on a two-thirds favorable vote the provincial government (through the responsible minister) may assent to the raising of the loan. Provision is usually made that the bond issue shall be large enough to carry operating and maintenance charges until the end of the year following the completion of the works. In this way the farmer may obtain benefit from the use of the water before his first payments become due. In the Lethbridge Northern District no payments towards sinking fund are required until after the seventh year. The form of bond, rate of interest and other details are subject to approval of the irrigation council of the provincial government.

The money is deposited to the credit of a special account of some person (usually the provincial treasurer) named by the lieutenant-governor. It is turned over to the trustees as required, the requisitions being subject to approval by the irrigation council. Construction is usually by contract. Bids are submitted to the council, with recommendation for acceptance. Monthly estimates are also submitted and disbursements made only on recommendation of the council. Approval of the completed works by the federal government is necessary, and when this is granted a license is issued.

Control of irrigation districts is exercised by the irrigation council, since it has the approval of annual rates and may forbid any action proposed by a board of trustees. The lieutenant-governor may at any time appoint an official trustee (which may be the council) to act in place of the board and conduct the business of the district. In other respects the act does not deal with the operation of the works. Under the Provincial Water Users District Act of 1920 groups of farmers may organize districts to take in bulk their share of the water for the area thus organized and undertake their own operation and maintenance work.

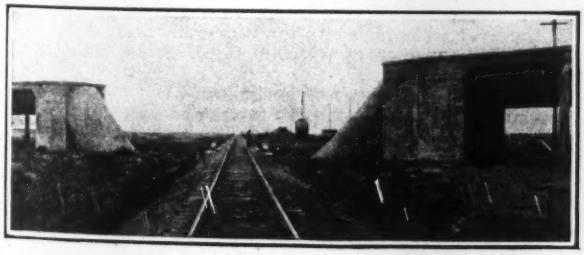


FIG. 3—SIPHON ON C. P. RY. AQUEDUCT

Aqueduct is passed under C. P. Ry. main line near Brooks, Alberta.

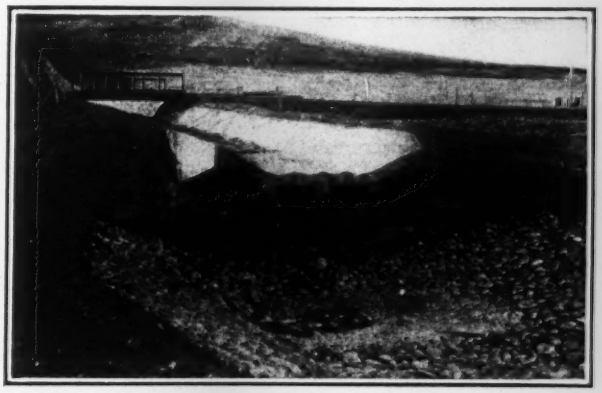


FIG. 4—CANAL OF UNITED IRRIGATION DISTRICT

Total drop on concrete-lined main canal, 65 ft.; capacity, 230 sec.-ft. Grouted stone paving on canal bed and sides.

Irrigation in Alberta—Irrigation development in Alberta was undertaken first by stockmen, taking water to grow winter feed. In 1900, the Alberta Railway & Irrigation Co. completed the first large project, diverting water from the St. Mary River for reclaiming about 130,000 acres near Lethbridge. This project was taken over later by the Canadian Pacific Ry., which has built other works (see *Engineering News*, Aug. 27 and Sept. 30, 1914, pp. 425 and 484; also Aug. 13, 1914, p. 354, for description of the Southern Alberta Co.). There are now six districts in operation, aggregating 1,075,000 acres; three projects approaching completion, 32,600 acres; eleven surveyed and designed, 649,000 acres; and one under investigation, 1,300,000 acres, making a grand total of 3,056,000 acres (see Fig. 1).

Under the Dominion Irrigation Act already outlined

the Minister of the Interior is authorized to make surveys to determine where the available water can best be used. Such surveys, made in Alberta from 1913 to 1915 and renewed in 1919, revealed possibilities of irrigation. Further field work, with canal locations and topographic and soil surveys, developed definite projects. The first large co-operative project of this kind is the Lethbridge Northern project for irrigating about 105,000 acres near Lethbridge, which was completed in 1923 and for which the bond issue amounts to $5,400,000. Surveys have been made for eight other projects aggregating 489,700 acres and studies are being made for five others aggregating 1,470,200 acres, but these are not likely to be carried out until the present districts are more fully settled.

Three successive phases of irrigation in the three northwest provinces may be classified as follows: (1) Individuals constructed works for small areas, usually under some measure of government supervision; (2) companies acquired large areas of dry land which they developed and then sold in farm units with water rights, the companies retaining ownership of the works and charging an annual maintenance tax; (3) farmers in well settled sections organized irrigation districts, sold bonds and constructed and operated works for their common benefit. This last phase has been expedited by the low precipitation since 1917, as a succession of dry years has had a cumulative effect in depriving the soil of its usual moisture and thus reducing the crop results on unirrigated lands.

Boulder Canyon Dam Opposed and Defended

Power Commission and Reclamation Engineers Hold Conflicting Views—Commission Favors Private Power Development

STRONGLY disapproving the Swing-Johnson bill for the development of the Colorado River, which is now before the Irrigation Committee of the House of Representatives, the Federal Power Commission last week went on record as opposed to any system of development of the river which includes power generation. In taking this attitude, the commission follows the lead of Col. William Kelly, who, as chief engineer of the commission, represented it on the Select Engineering Board which investigated the Colorado River during the past year and recently reported, as noted March 20, p. 503.

According to the figures presented by the power commission, the cost involved in the Boulder Canyon development would be: A dam 605 ft. high, $50,000,000; all-American canal and extensions and distributing system, $46,000,000; other irrigation canals in Nevada and Arizona, cost unknown; power houses and substations, $26,000,000; transmission lines, $46,000,000; total at least $178,000,000. The commission says, "It is unfair to assume that the entire project, flood control, irrigation and power development, can be secured in its entirety for less than $200,000,000, to which must be added millions of dollars of accumulated interest charges during the period of construction." The commission considers this expenditure excessive, and also questions the policy of charging the cost of flood control and irrigation storage against power users, who are, it says, "individuals and industries for the most part wholly unrelated to the area benefited. We are doubtful of the propriety or equity of so charging the cost of flood control and irrigation storage, whether the construction be financed by private or public capital."

On the question of a federal power development policy, the commission states that such a policy should be sanctioned by Congress only after full consideration of what the step means. The commission itself, however, declares such a policy "impracticable and undesirable," and uses an argument similar to that recently made before the irrigation committee by representatives of the Southern California Edison Co., that private industry now engaged in power generation and distribution would not extend its plants during the years of the construction of federal plants, if the federal power development policy were adopted.

"Electric power is only one element in industry, and if federal financing is justified in the present case on such grounds, it is similarly justified in all other cases and in all branches of industry," declares the commission.

In place of the Boulder Canyon development, the commission favors a dam for flood storage alone (without regard to irrigation) at the foot of the canyon section, to be followed subsequently by private power development at various sites at the head of the canyon section. The latter, it says, would render a reservoir on the lower river largely useless, and the Boulder Canyon dam is not adapted to fit the desirable scheme of development.

Unsettled treaty arrangements with Mexico concerning the respective rights of the two countries to Colorado River water are also urged by the commission against the Boulder Canyon development. It states that if increased flow is produced by the Boulder Canyon dam, it will at once be appropriated in Mexico; in the absence of treaty argument on the respective water rights, a right by appropriation would thus be created, to the detriment of lands on the American side of the boundary.

* * *

Reclamation Engineers For Boulder Canyon

TESTIMONY strongly supporting the Boulder Canyon dam project was given before the committee by Reclamation Bureau engineers. This testimony covered about the same ground as a report prepared by them during the past year under Congressional authority, in which the subject is summarized in a series of conclusions abstracted in the following:

There is immediate need of flood protection for river bottom lands in the lower Colorado basin and the Imperial Valley. There is imminent danger during each flood period that the river will break into the valley and destroy it.

There is a shortage of water in the Imperial Valley now each low-water year.

There are 415,000 acres of land now in cultivation in the Imperial Valley in the United States, and 190,000 acres in Mexico, but the Imperial Valley canal commands over 500,000 acres of Mexican land.

As one-half of the water diverted through the present Imperial canal belongs to Mexico, under a concession granted in 1904 for the construction of the canal, the water shortage for American lands in low years will rapidly become more serious unless storage is provided, for in such low years the American lands would have for periods only about half the water needed.

The area now in cultivation below Boulder Canyon is estimated at 700,000 acres. If storage can be provided, it is estimated that an additional 1,470,000 acres can in time be reclaimed.

The area now in cultivation above Boulder Canyon is estimated at 1,500,000 acres. An additional area of 2,825,000 acres may in time be reclaimed.

If a large reservoir is constructed at Boulder Canyon with a capacity of 34,000,000 acre-ft. it will so equalize the flow of the Colorado River as to permit the entire area below the reservoir to be reclaimed without in any way interfering with the development of the 4,325,000 acres of land above, provided all rights are subject to the provision of the Colorado River compact [between the states of the basin]. A reservoir of this capacity will also control floods and take care of the silt problem for 200 years or more.

The Colorado River brings down each year over 100,000 acre-ft. of silt, making it progressively more expensive to protect the valley by levees.

There has been spent since 1906 on levees below Yuma $7,500,000, for inadequate protection.

It will be cheaper in the end to rectify the river channel to the Gulf and maintain it between levees than to continue present levee methods. This method would be unsafe and would be more costly than flood protection by reservoirs.

With floods controlled to a maximum of 40,000 sec.-ft. by storage above Yuma, most of the difficulties with floods below there would be at an end.

A reservoir of 10,000,000 acre-ft. capacity will be required for flood control.

Such a reservoir can be constructed at Mohave [on the lower river] for about $26,000,000, provided foundation conditions are as favorable as at Black Canyon, which, from present information, is not thought probable. This site is objectionable for the reason that it would flood 40,000 acres of irrigable land and about 20 miles of double track of the Santa Fé Ry. and the city of Needles. It is not suited for a large reservoir as would be required for creating storage for irrigation of the area below or for creating a head for power.

A reservoir of 10,000,000 acre-ft. capacity can be constructed at Glen Canyon for about $77,500,000. Besides its high cost, this reservoir is open to the objection that it would not control the floods coming into the Colorado from large tributaries below it.

A reservoir of 10,000,000 acre-ft. capacity can be constructed at Boulder Canyon for about $28,000,000. Such a dam could be raised later. A reservoir of this capacity would take care of the silt problem for 100 years or more. It would be far better both from a structural and economic standpoint to construct the dam to its final height at the start and for a 34,000,000 acre-ft. capacity. This can be done for about $49,500,000, or only $21,500,000 more than for a reservoir for flood control alone.

The advantages of this site for flood regulation, irrigation storage and silt storage are as follows:

(a) It is readily accessible.

(b) Foundation conditions at the dam site are excellent.

(c) Construction materials of demonstrated suitability are available near the dam site.

(d) In contrast with a reservoir at Mohave valley, it would not interfere with any proposed irrigation project.

(e) Storage can be created in Boulder Canyon reservoir at less cost than at any other known site on the lower river, with the exception of a flood control reservoir which possibly could be built at about the same cost at Mohave valley.

(f) In case of the larger reservoir, the area of water surface exposed to loss through evaporation is far less than at Mohave valley.

(g) It is so located as to control discharge from all important tributaries with the exception of the Williams and Gila Rivers.

(h) It is nearest the land to be benefited of any point on the river where it is feasible to construct a reservoir adequately providing for ultimate requirements of flood control, silt storage and irrigation storage combined.

Any dam or reservoir constructed should fit into a general scheme of maximum practicable development for the purpose of irrigation and power. Head should not needlessly be sacrificed.

Numerous studies of alternative power possibilities on the lower river, using several different combinations of sites, show that power can be more economically developed at Boulder Canyon alone than at any other site or combination of sites, and since storage for silt, flood control, and irrigation can also be most economically developed there, it follows that Boulder Canyon is the site that should be first developed.

The Geological Survey in 1923 discovered what appears to be a favorable dam site in Bridge Canyon at an elevation of about 1210. Should the physical conditions at this site upon test and investigation prove suitable, the interests of Colorado River development may possibly be best served by reducing the height of the proposed dam in Black Canyon from 605 ft. to 550 ft., the storage to 26,000,000 acre-ft., the possible continuous power output from 667,000 hp. to 550,000 hp., and the cost from $49,500,000 to about $41,500,000. The cost per installed horsepower (1,200,000 and 1,000,000 hp. respectively) would be increased from $109 to $111.

Dams at Bridge Canyon and Black Canyon and a regulating reservoir at Bullshead where considerable power could also be developed would utilize the head from Grand Canyon National Park to Needles to the highest degree attainable and regulate the river in this section to the fullest extent for flood control, irrigation development, and power without interfering with upstream developments.

There is a market capable of absorbing within a period of seven years after completion of the dam the power output of a plant with a capacity of 1,200,000 hp. with a 55 per cent load factor, or 667,000 continuous horsepower, and at a price that will return the entire cost of the Boulder Canyon development.

The solution of the immediately urgent problems of the Colorado basin with due regard to future development is comprised in:

(a) The construction of the Boulder Canyon reservoir with a dam in Black Canyon raising the water surface 605 ft. and forming a reservoir of 34,000,000 acre-ft. capacity, with a possible alternative as described.

(b) The reservation of 8,000,000-acre-ft. capacity at the top of this reservoir for flood control, this reservation to be decreased in amount finally to 4,000,000 acre-ft. as the development upstream may justify.

(c) The provision of priority for irrigation use over power development for the remaining storage.

(d) The construction of a power house with 1,200,000 hp. installed capacity, with necessary transmission lines and other equipment.

(e) Construction of the all-American canal from Laguna Dam to Imperial Valley.

Propose Co-operative Railroad for Kansas

The Golden Belt Railroad Co. of Kansas has applied to the Interstate Commerce Commission for authority to construct and finance a new railroad entirely within the State of Kansas from a connection with the Santa Fe System near Great Bend, Kan., to a connection with the Union Pacific through Herzog, Buckeye and Riverview Townships in Ellis County, Kan., to the Saline River, a distance of 80 miles, and to a possible future connection with the Rock Island R.R. The Golden Belt R.R. is to be built by the cities and townships along its line of route who will furnish the stock and will be run as a co-operative railroad in the same manner as the co-operative stores and elevators in Kansas. It has no relation, traffic or otherwise, with any of the proposed connecting lines. The townships will elect their own directors and run the railroad for their own benefit and the public under the direction of a commission.

From Job and Office

Hints That Cut Cost and Time For the Contractor and the Engineer

Belt Conveyors Used in Placement of Stone on Mat Revetment

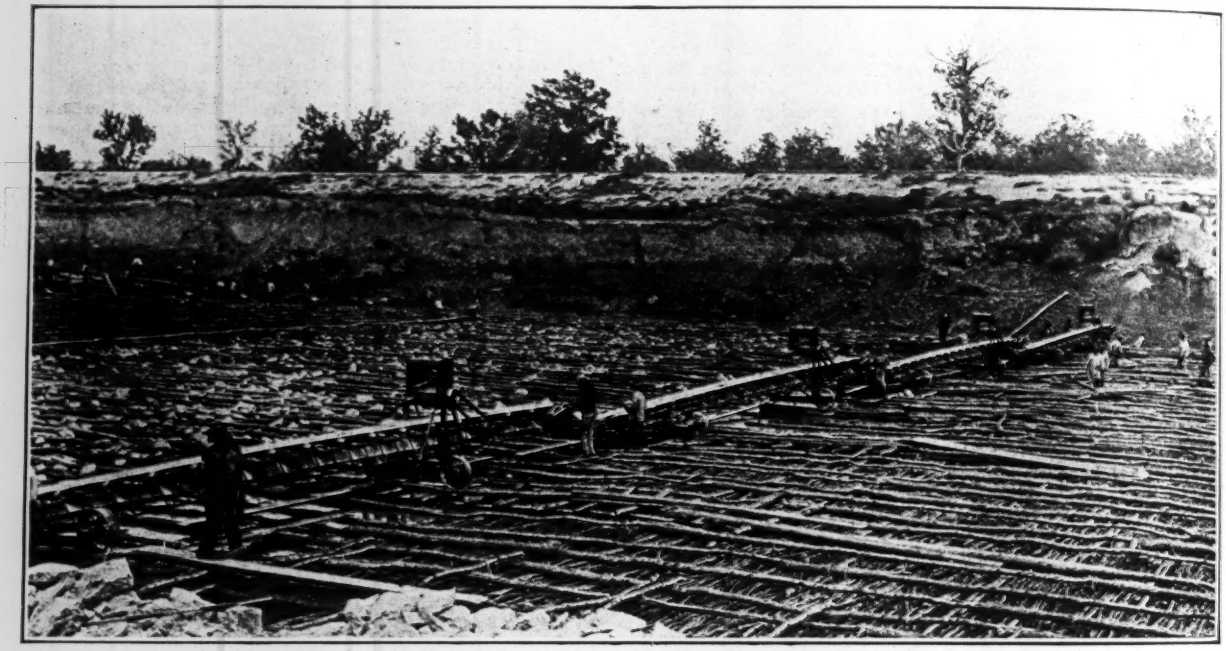
REPLACEMENT of wheelbarrows by belt conveyors in the distribution of ballast stone on fascine revetment mats has been successfully tried out by the Corps of Engineers in shore-protection work along the lower Mississippi River.

The standard mat is 250 ft. wide and 1,000 ft. long, though physical features of the bank govern dimensions of the mat to a certain extent. When the mat has been woven stone is distributed over it until the entire mat is washed. Then the end of the mooring barge is lowered and two barges of stone, end to end, are placed across the mat and stone is thrown off, the barges being pulled over the mat as it sinks. As the ballasting of the mats requires about 1 ton of rock to each 64 sq.ft., depending upon the size and buoyancy of the brush and the amount of sediment in the river, handling rock by hand is a considerable task.

The first mat upon which conveyors were placed as an experiment a few months ago proved unable to support both conveyors and ballast, the mat having been under construction more than the usual length of time and then held for trial of the conveyors. Another mat, therefore, of very tightly drawn and wired fascines, with poles set at 4-ft. instead of 8-ft. intervals, was constructed for the test. Some difficulty was experienced in moving the conveyors along the length of the mat because of the irregularity of the surface and because of the lightness of the planks used. The flexible nature of the mat made it difficult to lay the plank ahead at its proper spacing and inasmuch as planks were laid one on top of the other to support the weight of the conveyors, another difficulty was encountered in the planks slipping off each other. However, these objections were easily overcome in succeeding uses of the conveyor. Planks 3 x 14 in. and 18 ft. long were recommended for use on the next mat, and thus with six men conveyors can be moved simultaneously from one set-up to the other with little difficulty.

Comparison between the method of rock distribution by conveyor and by hand through wheelbarrows shows a great saving in time and a reduction in labor in favor of the conveyor method. It has been found that an experienced foreman and a crew of 35 men working the conveyors will be able to do the work of 100 men with wheelbarrows and do it more quickly.

Under actual operating conditions it has been found that conveyor No. 1 discharges upon No. 2 from an altitude of 6 ft. when the barge is loaded and 9 ft. when the barge is light. The first installation was made with only a small metal chute projecting from No. 1 to No. 2 so that the sharp rock, some of which weigh 75 lb., had a tendency to cut the rubber belt. The Barber-Greene Co. has suggested that this trouble be eliminated by placing a short section of conveyor between the two. This "belt" will have a positive drive from the head end of conveyor No. 1, and will operate in somewhat the same fashion as a short section of gravity conveyor. If this method is not adopted flexible metal chutes will be used.



PLACING ROCK ON MAT REVETMENT BY CONVEYOR

Rapid Rebuilding of Steel Viaduct in a Busy Chicago Street

THE RECONSTRUCTION of the Jackson St. viaduct over the tracks of the Chicago Union Station, in connection with the work on the new station, was a serious problem owing to the heavy traffic on this main thoroughfare. The work was accomplished in such a short time, 70 days, and under such erection difficulties as to be of general interest. When streets are closed for such purposes the public is apt to be left to find its own detours for an indefinite period, but in this case it was decided both to do the work as rapidly as possible and to provide convenient detours.

A traffic study showed that over 14,500 automobiles and 9,000 pedestrians cross the viaduct daily, while in an evening rush hour the figures were 1,532 and 1,100, respectively. It was found also that at the same time the adjacent streets on either side were but lightly used, so that the city authorities decided to divert traffic to these streets under strict regulations. An alternative plan considered was to keep half the width of the Jackson St. viaduct open during the reconstruction, but this would have throttled the traffic and also caused delay in completing the structure. Since this facilitating of the viaduct work would reduce its cost to the Chicago Union Station Co., this company paid about $6,000 towards the repaving of adjacent parallel streets to form satisfactory detours. On these detours, delivery wagons were not allowed to load or unload during rush hours. A special maintenance gang kept the paving in good condition and a special police patrol enforced the parking and traffic regulations. A large sign at each end of the closed street gave information as to the detours.

The viaduct, about 370 ft. long from the bascule span over the river west to Canal St., consisted of two through spans, one a three-truss and the other a three-girder span. This were dismantled without interfering to any extent with railway traffic below. Foundations for the columns of a plate-girder deck structure of seven spans had been built in advance. This new structure has three lines of longitudinal girders, with transverse steel floor framing and a reinforced-concrete slab floor paved with asphalt. The floor is complicated by the provision of flues or ducts to carry off smoke from engines passing underneath. All steelwork is cased with concrete poured in forms and a concrete parapet wall is built along each side. About 550 tons of steel and 2,400 cu.yd. of concrete were required for the superstructure. The width between parapets is 66 ft.

Erection of the steelwork was done with a stiff-leg derrick, having a 36-ft. mast and 90-ft. boom, which was placed on falsework at the street level, and a 30-ton locomotive crane working on the tracks below. This steelwork, including the dismantling of the superstructure, was done in 20 days. To avoid interference with station traffic the forms for the concrete were suspended from the girders instead of being supported by falsework resting on the ground below. For this arrangement, short angle bars laid across the top chords of the girders formed attachments for hanger rods which carried the form timbering beneath the girders and deck framing.

The street was closed on Sept. 15 and reopened on Nov. 24, 1923, all the work being done in seventy days. The general contractors for the viaduct were Paschen Brothers; the removal of the old structure and erection of the new steel was done under subcontract by the Overland Construction Co. The foundations were built by the Underground Construction Co. All this work was done at the expense of the Chicago Union Station Co., under the direction of J. D'Esposito, its chief engineer; W. W. Artingstall was engineer in charge for the city.

Lowering the Bottom of a 10,000,000-cu.ft. Gas Holder Onto Its Foundation

TWO HUNDRED forty-four screw jacks were used recently in lowering the bottom of a 10,000,000-cu.ft. gas holder onto its foundation for the Los Angeles Gas & Electric Co., Hollywood, Calif. The holder is 275 ft. in diameter and the part lowered weighs 450 tons. Jacks were arranged with an angle clip riveted on either side of the jack hole and diagonal braces bolted to either side of the nut on the upper end of the jackscrew. The lower end of the jackscrew was bolted to an angle clip on the bottom sheet. The lower end was set in a cast-iron cup on the foundation. The bottom of the holder was set on a 2-in. cushion of oiled sand. The whole operation of lowering the holder 27 in. took about 30 minutes. The Bartlett & Hayward Co., of Baltimore, were the contractors, and A. G. Kelley, engineer in charge of construction.

Deflection Chart for Timber Beams

By Kenneth S. Dodd
Tourbières de St. Laurent, Urt, France

A KNOWLEDGE of the deflection of timber beams and planks is generally useful and sometimes essential. Although the formula commonly used is not complicated, it involves the use of the fourth power when dealing with distributed loads. Owing to the variable nature of the material the results given by the formula are only approximate, and, if a certain limiting deflection is aimed at, a system of trial and

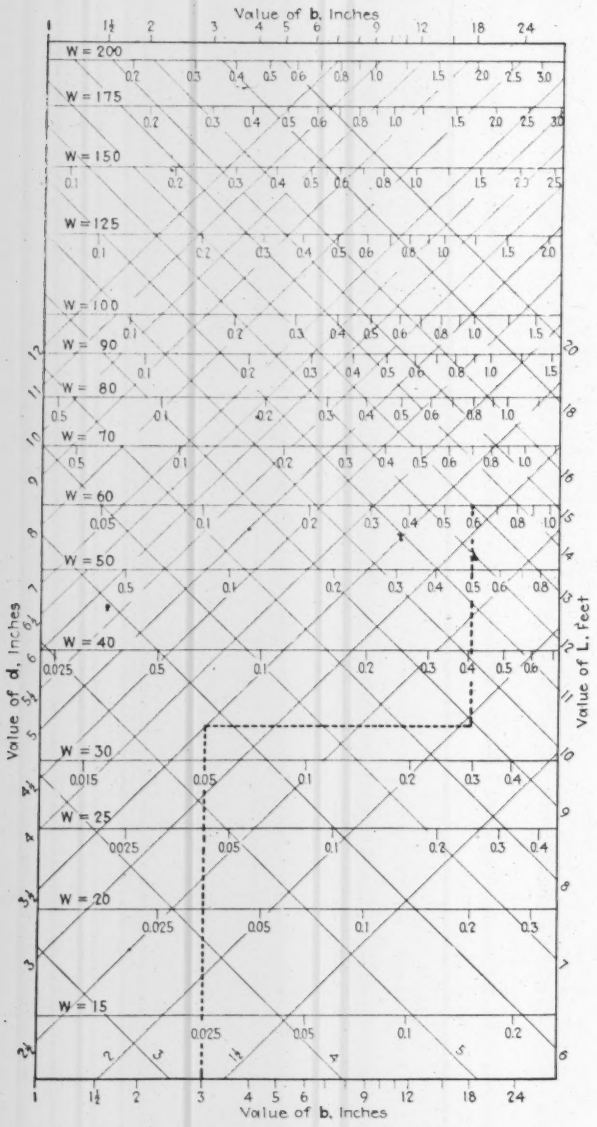


CHART FOR DETERMINING BEAM DEFLECTIONS

error is usually adopted to determine the dimensions of the beam. Economy of time and effort is obtained in such cases by the use of the chart here shown. Its accuracy is sufficient for the purpose in view, and its use eliminates the method of trial and error. The key will make the method of use self-evident. It shows how to find the deflection when the size of the beam, the span, and the load are given.

Certain values only of w are shown on the chart; it could be made to give any value within the limits, but this would entail another series of sloping lines, which, in the absence of color printing, would unduly complicate a chart of pocket size. Moreover, the conventional methods of arriving at "the equivalent dead-load" are often, in themselves, insufficiently accurate to warrant such an arrangement. A vertical scale giving values of the moments of inertia has also been omitted for the sake of clearness.

Referring to the chart, b is the breadth of the beam in inches, d the depth in inches, L the span in feet, w the equally distant load in pounds per foot and δ the maximum deflection in inches. The chart is for spruce in which the asumption is made that $E = 1{,}310{,}000$ lb. per square inch.

To use the chart begin with the known value of b and draw a vertical line until it intersects the line corresponding to the length of the beam. From that point continue in a horizontal direction to an intersection with the line giving the depth of the beam, then vertically to an intersection with the load line, where the deflection is found.

For timbers other than spruce multiply w by 1.23 for longleaf pine, 1.15 for Douglas fir, 1.13 for shortleaf pine, 0.91 for Norway pine, 0.88 for white oak and 0.86 for white pine. For loads W concentrated at the beam center use equivalent distance load $w = 1.16 \frac{W}{L}$ (W in pounds, and L in feet).

From Job and Office

Hints that Cut Cost and Time

Errors in Structural Steel Detailing

By J. Nelson
Toronto, Canada

THAT IT is human to err is very aptly demonstrated by the following compilation of errors met with in structural steelwork, all taken from actual practice over a period of years. They may appear very simple and obvious when put on paper, but the firms concerned were put to considerable time and expense to get things right.

Fig. 1 shows diagonal bracing between a pair of heavy columns in a power house. The gusset plates were shop-riveted to the columns. After the columns were erected, the plate girder was next placed in position. When an endeavor was made to get the bracing in place we were up against it; the gusset plates had to be removed from one face of the columns before the bracing could be set.

The crane girders on the same building were braced by a plate diaphragm from the upper section of the column, fitting in between the end stiffeners of the girder. The open holes in the girder were punched ⅞ in., while those in the diaphragm were only ⅞ in. This resulted in having to ream out about 400 holes at a height of 50 ft. from the ground.

While a steel stairway (shown in Fig. 2) was being erected, it was discovered that only about 4 ft. of headroom was available. The stair had to be scrapped and a new one made; cost, around $250.

From Job and Office

For Contractor and Engineer

In a factory building, conditions as shown by Fig. 3 were met with, not in an isolated instance but quite frequently. The bottom flanges of the shallower beams had to be burned off to allow for the rivets to be driven.

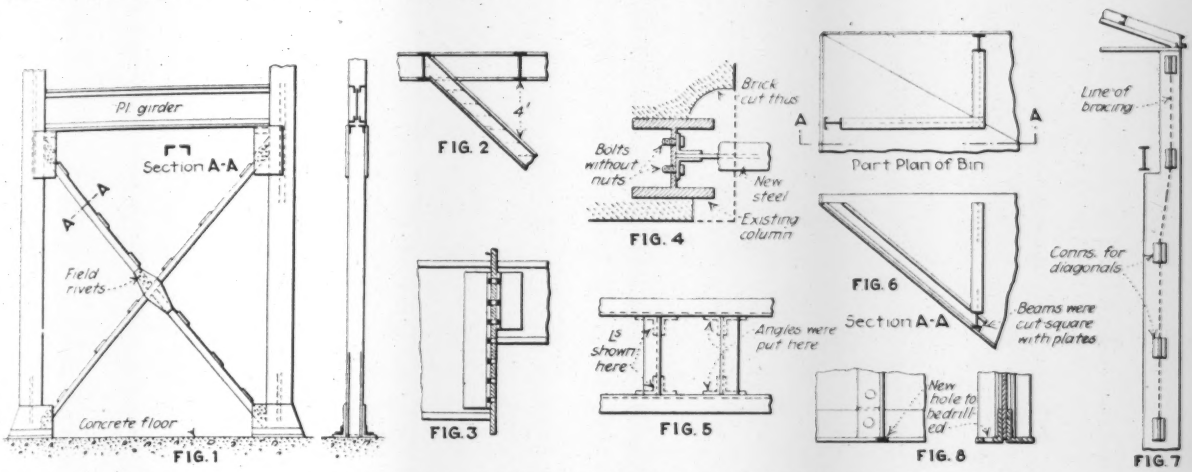
Fig. 4 shows new steel connecting to an existing frame. The masons failed to cut away sufficient brick to enable the erectors to get in the bolts, but the erectors did not report matters at the time, and the writer on an inspection tour found things as indicated.

Fig. 5 shows a special machinery support made up of 15-in. channels. The drawings distinctly showed the connection angles to be on the outside of the rectangular opening. The complete order of four arrived with these angle clips inside, just where they would interfere with the apparatus.

On a large hopper for cement storage, internal stiffeners of 10-in. I-beam section were located as shown by Fig. 6. When the adjacent side plates were put in position, it was found that these stiffener beams fouled considerably and also formed a pocket which would retard the flow of material.

In the column bracing system, Fig. 7, the lower section of the columns were about 20½ in. wide and the connections for the diagonals were placed on the center line of the web, while the upper sections were about 14½ in. and had similar connections also on the center of their webs. When these columns were erected, it was not surprising to find that the diagonals running from the lower to the upper column sections were cut somewhat off alignment. On the roof of the same building the end bay purlins were carried about 15 in. beyond the truss to form outlookers. Strange to relate the eave strut, which also acted as a lower purlin, was not so constructed, and quite a lot of patching had to be done to remedy the error.

Fig. 8 shows what happened when additions were made to existing framing. It was due to lack of primary investigation of actual conditions.



EIGHT EXAMPLES OF DETAILING AND SHOP ERRORS IN STRUCTURAL STEEL WORK

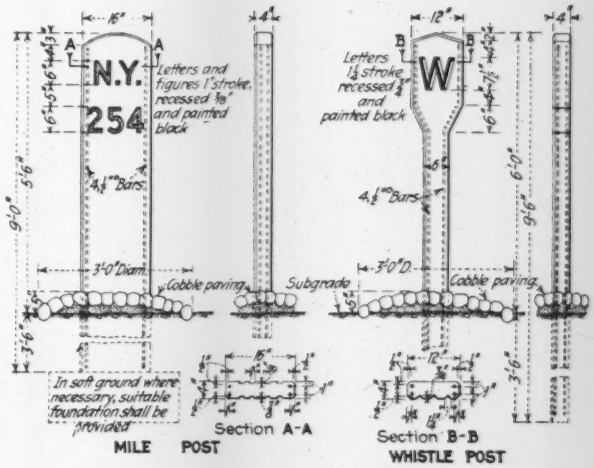
Mile and Whistle Posts Made of White Portland Cement

BY SAMUEL WARREN
Manager, Atlas-White Department, Atlas Portland Cement Co., New York City

MAXIMUM visibility and comparative low cost, coupled with durability, are the chief advantages in railroad mile posts and whistle posts made of white concrete.

All mile posts and whistle posts for the New York Central R.R. are now made of white portland cement-concrete, the aggregate being some such material as white silica, sand, and gravel. The use of ordinary gray concrete for such purposes is not new, but, although structurally satisfactory, the color is poor and the visibility low. Cut stone posts sometimes used are durable but also turn gray, causing low visibility.

Last year the cost to manufacture white concrete whistle posts amounted to approximately $4.50 including labor, materials and forms, and the whistle posts about $4.35 covering the same items. These costs com-

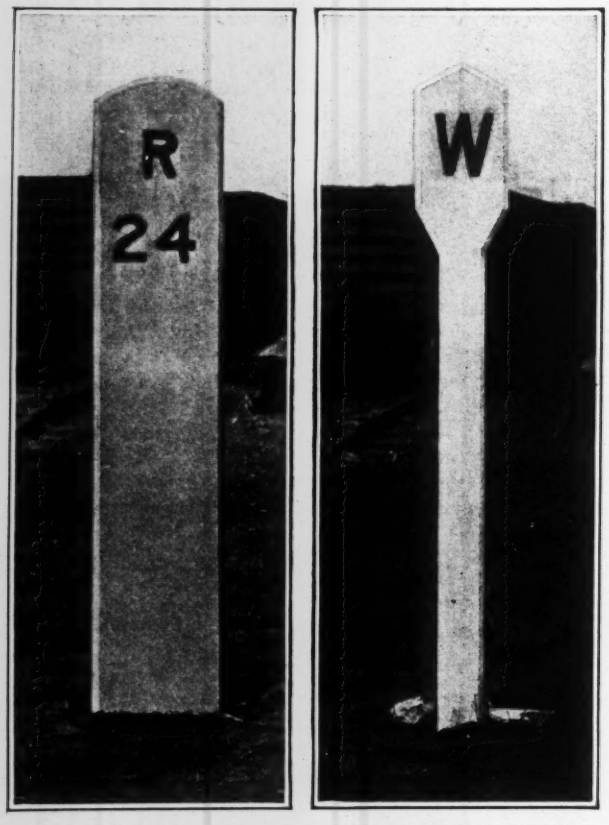


ELEVATIONS AND SECTIONS OF MILE AND WHISTLE POSTS

pare with about $1 apiece for wooden mile posts, almost $9 for cut-stone mile posts and $6.50 to $7 for wooden whistle posts.

As made by the company forces at the storeyards of the building and bridge department, posts are cast in simple forms but well made so as to be used repeatedly. For the whistle posts the "W" is recessed by nailing wooden strips to the forms. In casting the mile posts, reversed cast-iron letters and figures are secured to the forms and the recessed letters then painted black. As concrete is poured the forms are rapped with a hammer so that a dense concrete is secured and imperfections in the surface are avoided. The exposed side is troweled to a smooth surface. It is desirable to rub the surface with a little sand and water to remove the skin coat of neat cement which the troweling and suction of the form bring to the surface.

The mixture consists of one part of Atlas-White portland cement, two parts of white sand, and four parts of white gravel passing a ¾-in. screen. The reinforcing bars are laid in concrete as it is poured. After



POSTS INSTALLED ON NEW YORK CENTRAL LINES
High visibility and durability, with not excessive first cost, are principal advantages claimed for white concrete posts.

forms are removed, the posts are kept wet by sprinkling until thoroughly cured. They are ready for placing in about a month.

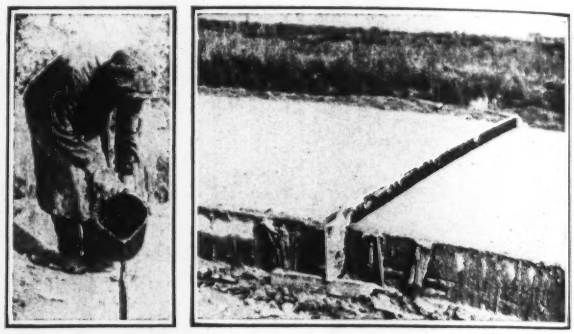
The whistle posts require 0.225 bbl. of white portland cement, 0.066 cu.yd. of sand, 0.132 cu.yd. of gravel, and four ½-in. round rods 8 ft. 6 in. long. The whistle posts require 0.10 bbl. of white portland cement, 0.03 cu.yd. of sand, 0.06 cu.yd. of gravel, and four ½-in. round rods 9 ft. long.

From Job and Office

Hints that Cut Cost and Time

Steel Cross-Header Forms Pavement Joint for Oil and Sawdust Filling

TRANSVERSE headers of steel were used in making the expansion joints on the recently completed Los Angeles harbor truck boulevard. These headers were milled to a thickness of 1 in. at the top and ¾ in. at the



PAVEMENT WITH STEEL CROSS-HEADER
Projection beyond header boards and slot used for prying up the header. The workman is filling the expansion joint with asphalt and sawdust mixture.

bottom, and the bottom was shaped to fit the crown of the roadway. The length was made sufficient to allow for an extension of about 6 in. on each side of the concrete, and in these projections slots were cut for handholes or for the insertion of iron bars to be used in prying up the plate. These headers cost about $60 apiece, and it was deemed advisable to provide four to avoid delay in the progress of the work. The engineer in charge of the work reports that they were found to be a great convenience, fully justifying the expense.

On this road the expansion joints were placed 200 ft. apart and were filled with a 3:1 mixture, measured by weight, of asphalt and fine sawdust. Measured by volume the proportions would be about 50-50. This proportion represented the maximum amount of sawdust that the asphalt would take up. Only dry sawdust was used, so as to avoid forming steam in the kettles.

Unique Device Facilitates Cutting Generator Shaft by Oxy-Hydrogen

MAKING a clean, straight cut through a solid steel generator shaft, weighing 40,000 lb. and 27 in. in diameter, in from ten to seventeen mnutes, with a gas consumption of 600 cu.ft. of hydrogen and 2,000 cu.ft. of oxygen per hour, operating on 75 lb. oxygen pressure and 60 lb. hydrogen pressure, was accomplished recently by the Purox Co. for the Milstein Co. of Los Angeles, California. The shaft was unloaded from the cars and the cutting done in the Los Angeles yards of the Union Pacific Railway Co., to whom the shaft had been sold for making drop forgings, thus necessitating cutting into proper lengths for handling in the forge shop.

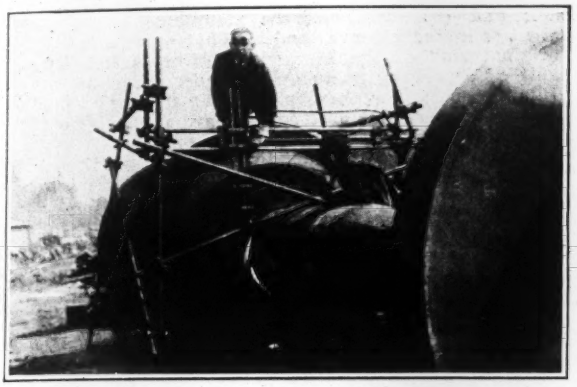
The rate of cutting was from 1½ to 2 in. per minute and cuts were completed in from ten to seventeen

From Job and Office

For Contractor and Engineer

minutes. Twelve and one-half feet each of ⅜-in. oxygen and hydrogen hose were used. Eight cylinders of oxygen were connected to a manifold on the high pressure side and the oxygen was delivered to the torch through four manifolded regulators. Eight cylinders of hydrogen were also connected to a manifold and the gas delivered to the torch through a single regulator.

Owing to the intense heat encountered in such heavy cutting and consequent punishment to the operator in



CUTTING 27-IN. SHAFT WITH OXY-HYDROGEN FLAME

attempting to manipulate a torch continuously for the length of time required to complete a cut, an ingenious device was rigged up to carry the torch at the required uniform speed up and over the shaft as the cut progressed. The device consisted of a pipe framework erected over the horizontal shaft and supporting two 1½-in. parallel steel rails laid 6 in. apart horizontally across the shaft and 3 ft. above it. The oxy-hydrogen torch was fastened to a carriage traveling on these rails and propelled by hydraulic pressure from a tee into the oxygen line. The water piston was arranged to pull in either direction, its speed being controlled by a needle valve.

Simultaneous vertical motion was also provided for by a device clamped to the torch and carriage, a second water piston controlling the speed; so that the torch traveled around the shaft, cutting the steel, with the tip held constantly at a distance of about ½ in. from the surface. Altogether five cuts were made with very narrow kerfs and extremely smooth surfaces.

Material for this article was supplied by the Compressed Gas Corporation, Denver, Colo.

Job and Office Notes

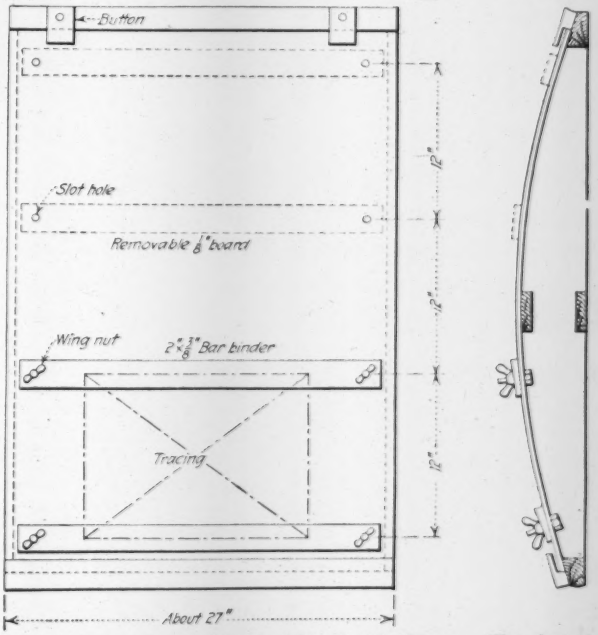
Unable to Find a Stretch of Level or near level ground upon which to measure a base line for a triangulation system in the Canadian Rockies, officers of the Geodetic Survey of Canada laid out that base line on the surface of a lake, waiting until the winter had frozen it solid. The work was done in the Yellowhead Pass region just west of the Alberta-British Columbia boundary and the base line was laid out on Yellowhead Lake. A concrete pier was first built over the triangulation station at the east end of the lake. From this point posts of the usual length were set in the ice at 50-m. intervals throughout the total length of 5,800 m., or a little over 3½ miles. These posts were set by cutting holes in the ice to a depth of about 10 in., putting the posts in position, then packing snow and water around them and leaving them to freeze overnight. When frozen the posts were in solid and no difficulty was experienced from shifting. Methods were adopted to eliminate any error which might be caused by the heaving of the ice. Measurements were carried on only when the weather would permit as the thermometers on the tape used to check the expansion and contraction registered no lower than 2 deg. below zero Fahrenheit, whereas at times during the progress of the work the temperature was as low as 32 deg. below zero.

The Following Theoretical Formula is offered by J. H. Bailey, chief hydrographer of the State of Colorado Engineering Department, for solving the equation of discharge curves and determination of the point of zero flow:

$$y = \frac{\frac{n-l}{c-a} - \frac{m-l}{b-a}}{c-b} x^2 + kx + r$$

where y = discharge; x = gage height; a, b and c are gage heights for discharges of l, m and n; k and r are constants which can be determined by substituting a, b, c, l, m, and n. Three measurements, or points, are of course necessary to determine the curve.

Where Crude Materials Alone are available, the blueprint frame herewith pictured can easily be assembled, writes J. Nelson, Toronto, Can., who used the frame during the



World War when with the Royal Air Force. The frame will take almost any size of tracing by the simple adjustment of the binder bar, slot holes being located at suitable distances for this purpose. As glass was not obtainable the frame was slightly cambered to give adequate contact between print paper and tracing. The frame, obviously, could not be used in wet weather.

A New Type of Tower-Anchor which has recently been devised will be used on the Illinois Power & Light Corporation's 76-mile transmission line between Keokuk, Ia., to Galesburg, Ill. A hole 8 ft. deep and 5½ in. in diameter will be dug where each leg of a tower is to stand. Then dynamite will be lowered into this hole and touched off. The explosion is expected to enlarge the lower end of the hole to a diameter of 2 ft., compressing the surrounding earth accordingly. The anchor arms will then be lowered into the hole and the hole filled with concrete. This type of anchor requires little excavation and leaves the earth above the "deadman" undisturbed.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

Otheographic Records of Rail Stresses

Sir—In your issue of March 13 p. 441 you publish an article entitled "Otheographic Records of Wheel Effects on Rails." I would like to call your attention to an obvious error made in lettering Fig. 2, which points out "Spring for lateral thrust." The spring in question is merely used to take up any possible lost motion in the recording mechanism. It will, of course, be understood that in order to secure a spring which will give only ¼-in. deflection for 20,000 lb. pressure, a much more substantial design must be used than in the coil spring indicated. As a matter of fact the springs consist of steel bars about 1 in. thick and 6 or 7 in. wide. Two of these are used for indicating both the vertical and horizontal thrust. An examination of the illustration will show you the location of these springs.

W. D. BEARCE,
Statistician, Railway Engineering Department,
General Electric Co.

Schenectady, N. Y.,
March 22, 1924.

Channel Deepening Due to Levees or Revetment?

Sir—Col. Chas. L. Potter, Corps of Engineers, U. S. A., and president of the Mississippi River Commission, made a notable contribution to your pages in an article by him published in your issue of Feb. 14, 1924.

Col. Potter's thesis is that the leveeing of the Mississippi River between New Madrid, Mo., and Helena, Ark., has had the effect of lowering the low-water plane between the above named points, his conclusion being deduced from a study of the low-water gage readings in that stretch of the river channel.

The channel of the river between Cairo, Ill., and Helena, Ark., is now undergoing a process of transition, a gradual modification resulting from a great change in its volume of flood-flow due to the leveeing of the St. Francis basin during the past decade, or a little longer period. Prior to the closing of this basin by levees about one-third of the flood-flow of the river between Cairo and Memphis passed out of the main channel and was bypassed through the St. Francis basin, returning to the river through the St. Francis River about ten miles above Helena. This condition had existed for an indefinite time in the past. The main channel between Cairo and Helena had adjusted itself to the accommodation of the limited volume of water to be carried. For example, taking a low-water profile of the river before the closing of the St. Francis basin, and drawing a straight line from low water at Cairo to low-water at Helena, it is found that the low-water plane at Memphis and points above has a superelevation above this line of between 7 and 8 ft. The range of oscillation from low to high water at Memphis during the former period was about 35.5 ft., while at Cairo and Helena this range was in the neighborhood of 48 ft. Now it may be anticipated, as a logical inference, that there shall be a gradual readjustment of these gage relations, since the same volume of flood-flow must pass Memphis that flows by Cairo and Helena; and that the final result shall be the attainment on the Memphis gage of the same range between high and low water as obtains at Cairo and Helena. This modification must be accomplished by an extension of the Memphis gage readings in both directions, by a lowering of the low-water mark and the raising of the high-water mark. It seems logical to expect that the low-water plane shall be depressed ultimately about 7 ft. at Memphis, and the high-water plane shall be elevated to a point that shall place the Memphis range of oscillation on a parity with Cairo and Helena.

It may be assumed that this process of modification shall be very gradual, as a large mass of material must be eroded from the river bed and carried down to the channel at and below Helena.

The suggestion presents itself whether this modifying process has already gone far enough to account for the depressed low-water plane between New Madrid and Helena as found by Colonel Potter. If this is true, then the effect must be directly attributed to the leveeing of this stretch of river channel, which is the contention of Colonel Potter. This seems improbable.

But to the writer's apprehension there is another and far more potent factor in causing a lowering of both the low- and high-water planes than the influence of the levees in confining the flood flow to the river channel.

This factor is bank revetment. Reasoning *a priori*, confining of the whole volume of flood water between levees must have the effect (1) of increasing the flood energy; (2) as a consequence, increasing its powers of bank erosion; and (3) increasing the magnitude of the caving activities in the concave bends. What may be termed the "original sin" of the Mississippi River is its confirmed habit of depositing in its own channel great obstructions to its own flood-flow, thereby elevating the flood plane during high water, and obstructing navigation at low-water periods.

The material used for building these obstructions is all derived from the caving banks in the bends immediately above. The volume of earth material that is dropped into the channel from the caving banks in some of the great bends must approximate 20,000,000 cu.yd. from a single bend in a single season. The writer has observed in a caving bend two miles long, in Desoto County, Mississippi, an estimated volume of between 10,000,000 and 12,000,000 cu.yd. that was tumbled into the river in one season. But in that locality the volume of water and other magnitudes are much less than in the bends below the Arkansas River.

These enormous quantities of caved-in material must be taken up by the current and disposed of before the next bend below is reached, where the current must be prepared to take up another similar load.

A large part of the caved-in material is immediately thrown off on the flank of the current, and serves to build out the "sand bar" on the opposite side of the channel which advances *pari passu* with the receding shore line along the caving bank.

But a very large part of it is carried down to the lower end of the bend, partly in suspension and largely in "sand waves" rolled along the bed of the river. In all of the caving bends there is a deep and narrow channel running close under the concave bank, the line of maximum depths being three or four hundred feet out from the bank. But at the lower end of the bend the current is deflected across the river to the opposite bank, and flowing across a wide expanse of shoal water, speedily drops its load of material brought down from the bend above. In this way is built up a "submerged dam"—what the steamboat men call a "crossing," the dam continually growing in elevation as the river rises, and when the flood recedes the increased slope over the crest of the dam causes the material to be carried forward into the pool below, until when the low-water stage is reached the dam resumes its low-water depth of 4 or 5 ft. over the crest.

These submerged dams must greatly reduce the discharge capacity of the river during floods, and thereby raise the elevation of the flood plane.

What is the remedy for these evil conditions? It is simple enough in principle; to wit, cut off the supply of material that serves to build the dams, and there shall be an end of the dams. The means of doing this is by securely revetting the caving bends, giving permanence to the shore lines, and fixation to the lines of flood-flow instead of constant changes in the positions of these flow lines.

Let us conceive a condition in which every caving bank on the Mississippi River shall have been securely revetted and all caving stopped, the shore lines made permanent. Then we shall see the great volumes of flood water surging down through the bends and over the crossings unburdened with sediment and without any load to carry, but its sole action must be to exert its enormous energy in removing the shoals and dams that now operate to obstruct its flow. This process must in time result in the complete removal

of these obstructions, with a consequent marked lowering of flood levels and a clearing up of obstructions to low-water navigation. How long a period must elapse after completed revetment before these results shall be completely realized is a matter of conjecture, but it seems certain that very beneficial results must soon follow.

Returning to Colonel Potter's position regarding the lowering of the low-water plane below New Madrid, the writer believes that the effects noted by Colonel Potter are more likely to be attributable to the extension of bank revetment in that region than to the confinement of the floods by the levees. Through the courtesy of Major Donald H. Connolly, of the U. S. Engineers, the following figures are made available as an exhibit here, bearing upon the extent of bank revetment that has been applied to caving bends between Cairo and Helena; to wit, total linear extent of bank revetment to this date, 35.97 miles; total extent of caving banks, in addition to the above, 73.75 miles. The length of river channel between the above points is 307.1 miles.

The extent of revetted bank bears a very substantial relation to the total extent of the caving bank. It should reasonably be expected that this proportion of protected banks ought to have an appreciable effect on lowering the height of the bars lying below the protected bends; and such lowering of low-water obstructions must be a condition precedent to the lowering of the low-water plane.

Query: Is this effect to be attributed to the levees, or to bank revetment? The writer believes that the latter affords the true explanation. The writer agrees with the late Gen. C. B. Comstock, once president of the Mississippi River Commission, who said that in his opinion confining the flood water between levees could have no effect on the low-water channel of the river.

The channel of the river from Baton Rouge, La., to the Gulf lies in the "flat slope" division of the river. Here the cross-section of the channel is large, and relatively symmetrical. The flood water passes down between levees at a very moderate velocity, too low to give current energy sufficient for active bank caving, the extent of which in this part of the river is almost negligible. The result is that there are no sand bars, shoals, nor submerged dams in this division of the river, because the absence of caving banks gives no material for the building of such obstructions. Consequently there is plenty of water for low-water navigation, and oceangoing steamers can run up to Baton Rouge and above at all stages of the river. Here is an admirable demonstration of the beneficial effects upon channel conditions due to the elimination of bank caving.

There seems no reason why similar channel conditions may not be created in the upper part of the river's "main trunk" through the agency of bank revetment, by which caving banks shall be eliminated in all the caving bends above.

Levees are admittedly essential for the protection of the riparian lands from overflow. But considered solely as a factor in solving the great problem of bringing the Mississippi River under control and regulation, to bank revetment must be assigned the place of prime importance, and to levees a secondary place.

T. G. DABNEY,
Consulting Engineer.

Memphis, Tenn., Feb. 29, 1920.

[This letter was submitted to Col. Potter, who replied as follows.—EDITOR.]

Sir—I have your letter of March 8 asking if I have any remarks to make in reply to the comment of Major T. G. Dabney on my levee article.

It is far from my desire to enter into controversy with my long-time friend Major Dabney, for in doing so I would feel like a schoolboy trying to correct the schoolmaster. The major has been engaged on the Mississippi River so many more years than I that it would be presumptious on my part to disagree with him to any material extent, but I do submit some remarks on the extent of revetting.

Major Dabney states that there were 73.75 miles of caving bank between Cairo and Helena, in addition to 35.97 miles which have been revetted. The distance between Cairo and Helena is 307.1 miles, as he states. There are therefore 614 miles of bank, besides the islands where caving may be active on one side or the other. The St. Francis Levee District in Arkansas extends from the Arkansas-Missouri state line to the mouth of the St. Francis River, and thus covers one bank only from mile 130 to mile 300—roughly 170 miles out of the 614 miles of total bank line, or slightly under 28 per cent, not counting caving on islands. In November, 1922, H. N. Pharr, engineer for that levee board, came before the commission asking for early revetment of 32 miles of river bank, in his district, where levees were threatened by caving—this in addition to revetment already in place. We know that there are miles of caving banks in that district, which are not threatening any levee. I have no hesitancy in making the statement that there are more miles of active caving banks in this 28 per cent of the total bank line (again not counting islands) between Cairo and Helena, than Major Dabney figures as still necessary to revet (in the whole 614 miles) in order to stop the dumping into the river of these immense burdens of silt.

I doubt if 20 per cent of the caving banks and islands between Cairo and Helena have been revetted. Again 20 miles, of the existing 36 miles of revetment, were done prior to 1893. Therefore between the time when modern levee building was begun in these basins (1893) and the present time, there have been added but 16 miles of new bank revetment, which will not represent 10 per cent of the original caving main banks and islands.

Query: Should credit for the changed conditions be given to a levee system, increased in 30 years from 0 per cent to 100 per cent in efficacy, or to bank revetment, increased in the same time possibly from 10 per cent to 20 per cent?

I have the greatest respect for the opinions of both the late General Comstock and my friend Major Dabney, but am still inclined to give the credit to levees rather than to bank revetment, under the circumstances.

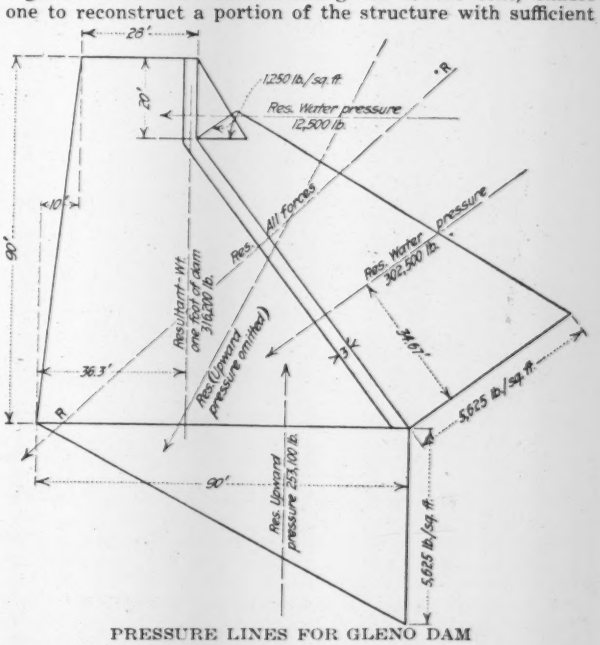
CHAS L. POTTER,
Colonel, Corps of Engineers, U. S. Army,
President, Mississippi River Commission.

St. Louis, Mo., March 11, 1924.

Cause of Gleno Dam Failure

Sir—The failure of the Gleno Dam in Italy, described in your issue of Jan. 31, where about 500 persons lost their lives, can be fully explained on the simple principles of mechanics and stability, though, of course, we must expect long reports and results of investigation.

To all intents and purposes this structure was a gravity dam; for while it consists of a series of arches between buttresses, and while the line of these arches and buttresses is on a circular arc for the part of the dam which went out, it can readily be shown that gravity action and not arch action predominated. The excellent views of the dam, together with some dimensions given in the text, enable one to reconstruct a portion of the structure with sufficient



PRESSURE LINES FOR GLENO DAM

nearness to actual dimensions to reach a very good conclusion as to the stability. Using the dimensions given, and scaling the photographs for those not shown, I have built up an approximate cross-section and have worked out the forces on a constructive foot of the dam. These results are shown in the adjoining diagram. It is estimated that the average weight of the dam per running foot is 0.4 of solid weight. A deck is assumed 3 ft. thick, continuous, and having the full weight of concrete; this is to represent the arches.

A foot of this constructive gravity section is estimated to weigh 316,200 lb. and its center of gravity to be 36.3 ft. from the downstream toe. The water pressure on the inclined portion of the deck is 302,500 lb. and that on the vertical part near the top is 12,500 lb. Besides these forces a vertical force from under pressure is assumed. The resultant of all forces except the upward pressure falls well within the middle third of the base. This seems to indicate clearly that the proportions of the dam were made such as to give this condition, in accordance with the standard method of designing dams which prevailed up to about 13 years ago.

A force is introduced in this diagram which represents upward force of water that may work its way into a horizontal joint in the masonry base on which the buttresses rested. This upward pressure is assumed to vary in intensity from full head at the upstream edge to zero at the downstream edge. When this upward force is combined with the other forces, the final resultant is RR. It is seen that this resultant passes close to the downstream edge. The overturning effect of this force and the crushing load concentrated near this edge are enough to account fully for the failure.

It will doubtless be urged against this explanation that the under surface of the buttress is only about six-tenths of the top of the base on which the arched portion of the dam rested, and that this would diminish the upward pressure. But consider a mortar joint or bed in this masonry base a few feet below the base line of the buttress. The forces of Fig. 2 would not be materially altered. In any event this is not intended to be an exact but an approximate solution.

Dr. Stucky's explanation of the failure is not satisfying. He attributes it to shear failure in the buttresses, and yet he finds very small unit shear in these buttresses. He passes over underpressure very lightly, saying that it is "considered to be of very minor importance" in a dam of the present type. Why? Just last week *Engineering News-Record* published an account of a concrete block being separated in an almost horizontal plane and part of it weighing nearly 1,000 tons raised 15 ft. Are such forces to be ignored?

Dr. Stucky says "The percolation of water through the rubble masonry base may have caused enough leaching out of the lime mortar to weaken its supporting power and simultaneously set up a bursting pressure sufficient to change the stress conditions in the buttresses."

Why should there be a "bursting pressure" in a "dam of this type"? Is it not immune from under pressure because it is of the hollow type? Is not the water there by capillarity?

Why are not dams designed for the pressures they may be subjected to?

EDWARD GODFREY.

Pittsburgh, Pa., Mar. 21, 1924.

Concrete in the Pittsburg Road Test

Sir—I noted with interest the article by Troy Carmichael in *Engineering News-Record*, March 6, 1924, p. 418, in regard to concrete pavements, and especially his comment on the results of the Pittsburg test regarding plain and reinforced concrete.

A little consideration given to the position and manner of destruction of the different types of concrete pavements in the test track at Pittsburg might be illuminating as to why the plain concrete, which was all on the curves, held up better than the reinforced concrete, which was on the tangents.

Every jar and blow from the vehicle to the pavement on the tangents is delivered at right angles to the surface, the most effective manner in which it could be delivered to fracture the pavement. Is the same thing true on the curves? Hardly. There, owing to the tendency of the vehicle to slew or skid the blows are all more or less glancing, thereby losing their effectiveness to fracture the pavement. It is like a man proceeding to break a slab of concrete with a hammer. Let him hit it a clean square blow and it will break very easily, but let the blows be glancing if only slightly and he can maul away for some time before he manages to break it.

To my mind the plain concrete sections in the Pittsburg test track stood up better than some of the rest of the track, not because they were inherently better sections but primarily because they were located in the curves where the downward blows from the traffic were largely robbed of their destructive effect on the pavement by virtue of the curves.

Had some of these plain concrete sections which held up so well in the curves been placed on the straight-aways and more of the reinforced sections in the curves I think it would have led to somewhat different conclusions in regard to the respective merits of plain and reinforced concrete in pavements.

A. TIGGELBECK.

Sandpoint, Idaho, March 12, 1924. Civil Engineer.

Sand-Asphalt Road Costs

Sir—Referring to the article in *Engineering News-Record*, Jan. 17, 1924, p. 114, on "Itemized Cost of Sand-Asphalt Road Construction," presumably this interesting information is accurate as far as it goes, i.e., for costs of labor, materials and freight. Accuracy, however, demands going a good deal further to arrive at correct costs, after which the contractor must add his profit or head for bankruptcy.

The published basis of costs unfortunately is the basis on which engineers generally and contractors quite frequently base their estimates. Such contractors sooner or later "fall by the wayside" and a considerable number of them so fall each year. Some of the important items, all of which are as necessary as stone and labor, which are omitted in the published statement are the following: (1) Equipment, freight, erection, dismantling; (2) surety bond premium; (3) liability insurance; (4) maintenance reserve, if maintenance is required by the contract; (5) contingency allowance, such as unusually bad weather and many other immeasurable items, some of which always occur; (6) general expense; (7) discount on securities, if contractor is not paid in cash.

The table which accompanies the article figures interest at 1 per cent. Theoretically, this may be correct on some basis of contract payment terms, but it is entirely too little based on the payments which contractors usually receive even in cases where the contracts provide monthly payments on account of work done. It seldom happens that the contractor in fact gets his pay nearly as rapidly as his contract provides and in the case of contractors doing a large business this means millions of unanticipated investment on work.

WARREN BROTHERS COMPANY.

Boston, Mass., Feb. 23, 1924. GEORGE G. WARREN, Chairman Executive Committee.

Agents' Commissions in Contract Bonding

Sir—It has just come to my attention that, in publishing my reply to Mr. Towner, in *Engineering News-Record*, Jan. 10, p. 68, a very serious error was made. In the quotation from the report of the Joint Committee of the American Association of State Highway Officials and Associated General Contractors of America, near the bottom of the second column on page 69, the first sentence reads:

"Agents are reported as receiving commissions amounting to as much as 30 to 50 per cent of the total premium," etc.

It is my recollection that the copy read "30 to 35 per cent of the total premium." I would greatly appreciate a correction as I find that in a letter from Mr. Towner to L. G. Holleran, Deputy Chief Engineer, Bronx Parkway Commission, Bronx Park, New York, which was recently published by "Nerba," of the New England Road Builders' Association, Mr. Towner takes sharp exception to the statement that agents were receiving commissions amounting to as much as from 30 to 50 per cent, and confirms the statement which was made by the Joint Committee that they amounted to as much as 30 to 35 per cent.

H. H. WILSON,

Harrisburg, Pa. March 25, 1924. Managing Partner, Winston & Co.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Am. Soc. C. E. Directors Meet at Atlanta

Demand Civilian Control of Non-Military Engineering—Oppose Proposed Sale of Muscle Shoals

Engineering News-Record Staff Report

Strong resolutions demanding civilian control of all non-military engineering work of the government and opposing the proposed sale of the Muscle Shoals plant were adopted by the Board of Direction of the American Society of Civil Engineers in Atlanta April 7 and 8, preceding the opening April 9 of the spring meeting of the Society. The Board also commended Secretary of the Interior Work for appointing Dr. Elwood Mead Commissioner of Reclamation (noted elsewhere in these columns). In the field of society affairs the Board established the annual conference of local sections and authorized the formation of a structural division. It re-elected Secretary Dunlap by unanimous vote.

In its resolution on non-military work the Board declared that "the government's policy of maintaining non-military work under Army officers has deprived the government of the services of much of the best engineering talent" and urged that in the interests of the people "all river and harbor work including that of the Mississippi River Commission and all other non-military engineering activities of the government should be under civilian and not under military direction."

Muscle Shoals Resolution

On the subject of Muscle Shoals the Board declared that the development should not be sold until full information on power, on nitrogen fixation possibilities and on costs has been collected by a fact-finding commission and that Congress should not deal with Muscle Shoals in any manner differing from the terms of the federal water-power act. It also asked that Congress give opportunity for presentation of plans by which the cost of the plant may be recovered in the shortest possible time and that Congress place the sale or lease of the plant on an open competitive basis.

According to the rules established for the conference of local sections this body is to consist of one representative from each section and is to meet at each annual convention with the officers of the society, and is to make recommendations to the Board. The first meeting is to be at Cincinnati April 20, 1925.

Charles H. Paul, of Dayton, was elected a director in place of R. N. Begien, who resigned following his change in residence from the district he represented. George S. Davison, George C. Mason, Mansfield Merriman, Charles F. Loweth and Anson Marston were named a committee on ways and means to collect funds for research and technical work. Resolutions in memory of John A. Ockerson and Walter J. Francis were adopted. No progress was reported in registration legislation, but a draft of the model law is expected to be ready for the meeting in Pasadena this summer. Salt Lake was fixed as the place for meeting in the summer of 1925.

Smith Heads Oil Investigation

President Coolidge has appointed George Otis Smith, director of the U. S. Geological Survey, to head a commission of three members to make an examination into the general subject of naval fuel oil reserves. The other members of the commission are Admiral Hilary P. Jones, a member of the General Board of the Navy and until recently commander-in-chief of the Atlantic fleet, and Reed D. Bush, state oil and gas supervisor for California.

300-Ton Refuse Incinerator Opened in New York

As a part of a program for installing district waterfront incinerators for the mixed refuse of Manhattan Borough, New York City, a 300-ton incinerator of the Decarie type was officially opened at 56th St. and Twelfth Ave. on April 2. It was built under the direction of Grover Whalen, Commissioner of Plants and Structures. A. R. Taylor is Commissioner of Street Cleaning.

Phenol Tastes Lead to Suit

Phenol tastes in the Cleveland water supply have led to a taxpayer's suit asking that the Otis Steel Co. be enjoined from discharging phenol by-products in such a way as to affect the water.

Blowout Occurs in Vehicular Tunnel at New York

A blowout occurred on April 13 at the shield of the south tube at the Manhattan end of the vehicular tunnel now being constructed between New York and New Jersey. The shield where the blowout occurred is working partly in rock and partly in river silt about 200 ft. beyond the pierhead line. The cover at this point is light and the air pressure has to be kept as low as possible. At the time of the accident it had been increased slightly on account of difficulties with water at the shield. The increase was, however, too much for the light cover which gave way letting out the air in flooding the working chamber. The thirty men in the chamber took refuge behind the safety bulkhead and passed out through the air lock.

Testimonial Dinner Given A. P. Davis in Washington

Former Reclamation Head Honored By Engineers and Men in Public Life —Hoover Pays Tribute

Washington Correspondence

Never before in the history of the federal government has a discharged employee been so honored as has A. P. Davis, the former director of the Reclamation Service. His departure from Washington to reside permanently in California was made the occasion for various tributes indicative of the appreciation in which he is held by fellow engineers and by his former associates.

More than 500 engineers attended a formal dinner April 5 at which Mr. Davis was the guest of honor. The dinner was under the auspices of the District of Columbia Section of the American Society of Civil Engineers and of the Washington Society of Engineers. On that occasion, Commerce Secretary Hoover, former Interior Secretary James Garfield, C. E. Grunsky, president of the American Society of Civil Engineers, and M. O. Leighton, lauded his long and successful public service.

Despite the fact that Mr. Davis had been summarily dismissed from office by the present Secretary of the Interior, in a way intended to reflect adversely on Mr. Davis' professional ability, the employees of the Bureau over which he had presided, at the risk of displeasing the head of the Department, presented Mr. and Mrs. Davis with a solid silver service.

Hoover Pays Tribute

Secretary Hoover, in the course of his remarks at the banquet, declared that the Bureau of Reclamation is Mr. Davis' monument. He mentioned some of the outstanding projects which had been planned and constructed by Mr. Davis and said that "no one can question that he has given stature to the profession."

Former Secretary Garfield referred to Mr. Davis as a man whose "feet are constantly on the ground" and the one "who first opened my eyes to the practicality and the high idealism of engineers." In his relationships with him during the period that he was secretary, Mr. Garfield said he formed a high respect for Mr. Davis' ability and that he was always willing to accept his facts and figures.

Davis, the man, and Davis, the engineer, were referred to in a highly complimentary way by Mr. Grunsky and by Mr. Leighton. Mr. Davis, in expressing his appreciation of the honor which had been paid him, asked that "you remember my virtues, if I have any, and forget my shortcomings, if you can."

Elwood Mead Appointed To Head Reclamation Bureau

Engineering Direction Restored—D. W. Davis Becomes Chief of New Division of Finance

Washington Correspondence

Conduct of the federal government's reclamation activities again is in the hands of an engineer. D. W. Davis, the business man chosen by Secretary Work as Commissioner of Reclamation, has been removed from that position and Dr. Elwood Mead has been selected as his successor. Mr. Davis will continue with the bureau. He has been placed in charge of a newly created division of finance. This division is being set up at the suggestion of the advisory committee on reclamation. It will be the Bureau's collection and credit agency. The advisory committee is of the opinion that project managers should be relieved of the burden imposed upon them in connection with the handling of accounting matters. It will be the duty of Mr. Davis in his new capacity to recover as much as possible from overdue accounts and to devise means whereby such accounts can be obviated in the future.

When A. P. Davis, the former Director of the Reclamation Service, was advised of the appointment he said no better selection could have been made. His long experience, his administrative ability, his resource and his ability to be constructive, the former director declared, makes the choice a particularly happy one. Mr. Davis expressed the opinion that he would be a great asset to the water users and to the federal government. "You cannot speak too highly of Elwood Mead," he added. "He is pure gold."

Work Issues Statement

The statement issued from the office of the Secretary of the Interior announcing the appointment of Dr. Mead says:

"At the request of Secretary Work, Dr. Elwood Mead, professor of rural institutions in the University of California, and until recently chairman of the state land settlement board, has been granted leave of absence to become Commissioner of Reclamation in the Department of the Interior.

"He has had a lifelong experience in irrigation administration, beginning as assistant state engineer of Colorado, then state engineer of Wyoming, then chief of irrigation and drainage investigations of the U. S. Department of Agriculture, chairman of the state rivers and water supply commission of Australia, consulting engineer of the Interior Department and of a number of countries in which irrigation is an important problem. Dr. Mead is a graduate in engineering and agriculture of Purdue University and of Iowa State College, a member of the American Society of Civil Engineers and other engineering bodies, and an honorary member of the American Society of Agricultural Engineers. Since last December he has been engaged with the Advisory Committee on Reclamation, reorganizing that service in the Interior Department, a report on which is pending.

"Dr. Mead will take up his duties at once and put in operation the new policies developed by this committee and the Secretary of the Interior, who will promulgate them as rapidly as practicable.

"A division of finance has been created in the Bureau intended to separate the handling of receipts and disbursements from the engineering and agricultural divisions. Over 25 millions in accounts are now classed as deferred, doubtful and bad. An attempt will be made to develop a system that will recoup these losses if possible and obviate or minimize these leaks in the future. Former Commissioner D. W. Davis becomes director of this important division of the service."

Senator Warren, chairman of the Senate Appropriations Committee, on April 7 at the request of Secretary Work introduced a bill providing that, under the supervision and direction of the Secretary of the Interior, reclamation of arid lands under the act of June 17, 1902 and acts amendatory thereof and supplementary thereto, shall be administered by a commissioner of reclamation, who shall be equipped for the duties of said office by practical experience in irrigation of arid lands and the agricultural development and utilization thereof, and who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall receive a salary of $11,000 per annum.

In a letter to Senator Warren, Secretary Work says in part: "Under the reclassification which will become effective July 1, 1924, the salary of this position will be limited to $7,500 per annum on and after that date. Dr. Mead has been in receipt of a salary of $11,000 per annum from the University and State of California and felt that he could not afford to sacrifice his position for that of commissioner, but I have persuaded him to accept, with the hope that Congress will increase his salary to an amount equal to the salary he has been receiving.

"It will be impossible to secure and retain the services of such a man at the present salary allowed this position. I therefore hope that you will see your way clear to introduce and press legislation along the lines proposed in the attached draft of the bill."

New Power Development Proposed for Northern Pennsylvania

The Pennsylvania Power & Light Co. has applied to the Federal Power Commission for a license covering a power site on the Wallenpaupack Creek in northeastern Pennsylvania. The plans call for the construction of a reservoir with a capacity of 160,000 acre-ft., a pipe line to develop a head of 300 ft., and a power house on the Lackawaxen River where about 50,000 hp. will be produced.

Beach Would Extend Influence of Corps on Mississippi

A draft of legislation which would give the Corps of Engineers of the Army the same jurisdiction over the Mississippi river between Cairo and the head of The Passes as it has over other navigable streams has been submitted to the Rivers and Harbors Committee of the House by Maj. Gen. Lansing H. Beach, the Chief of Engineers

In supporting his proposal Gen. Beach told the committee that if there ever were any real reason for the existence of the Commission, it has passed. Representative Newton, of Missouri, blamed the Commission for a $500,000 financial loss suffered by the barge line, in addition to loss of prestige because of the Commission's failure to maintain the river's channel properly. He characterized the Commission as being "saturated with superannuation and obsolescence."

U. S. Chamber to Meet in May

Outstanding manufacturing problems will feature the annual meeting of the Chamber of Commerce of the United States to be held in Cleveland May 6-8. The general sessions will be devoted to three major topics: "Business and Agriculture," "European Readjustment," and "The Responsibility and Integrity of Business." A special group meeting of leading manufacturers will be held on the opening day of the convention under the auspices of the chamber's department of manufacture. At that special group meeting the following subjects will be considered: "Obligations of Employer and Workers in Successful Production," "The Simplification of the Government's Purchases," and "Industrial Pensions or the Care of Faithful Workers."

Building Congress Adds Many New Members in Drive

So successful was the drive for new members in the N. Y. Building Congress, which was to have terminated last week, that 132 members, constituting 33 working committees, insisted on a continuation of the membership campaign. The committee's have included leaders in every department of the building industry: Architects, engineers, real-estate men, financiers, contractors, labor leaders, manufacturers and dealers in equipment. An original mark of 600 members for the four days drive had been set, but when the four report luncheons had been concluded it was found that a total of 836 applications had been received. It is expected that by the time the last report luncheon, April 10, is held, at least 200 additional members will have been added, bringing the total in the N. Y. Building Congress up to more than 1,400 members.

An analysis of the results of the campaign shows that more than 50 per cent of those whom the committees were actually able to reach within the four days originally planned for the campaign became applicants for membership.

Canadian Pacific Plans New Work

The program for expenditures amounting to $6,769,000 for 1924 by the Canadian Pacific Ry. includes the following items: new permanent structures, $508,115; laying heavier rails, $1,286,850; track material and improvement, $1,124,230; terminals and side tracks, $719,916; additional lining in Connaught tunnel, $570,000; freight and passenger stations, shops and engine houses, $901,576; shop machinery and telegraph improvement, $546,700. Extensions of branches are proposed as follows: Moosejaw Southwestern, 37 miles from Consul; Leader Southerly, 25; Amulet-Dunkirk, 25; Suffield southwesterly, from Lomond, 10 miles; Archive-Wymark, to Coderre, 12 miles; Tufnell & Prince Albert, 79 miles. In addition, it is proposed to complete pier B-C at Vancouver, B. C., in 1½ to two years at a cost of $4,000,000.

Span of Railway Bridge Wrecked by Shifted Load on Car

Special Correspondence

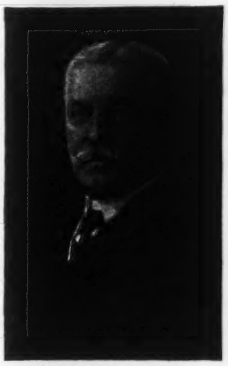
The north span of a bridge of the Chicago, Indianapolis & Louisville Railway Co. (Monon Route) over the Wabash River, north of Lafayette, Ind., was wrecked on the morning of April 4, 1924, while a freight train was passing over the bridge. The span was a riveted double intersection through truss about 140 ft. long, one of three making up the bridge.

According to the report a southbound freight train, consisting of 78 cars, was passing over the bridge at the time of throwing 15 loaded and 5 empty cars into the river. Several of these cars were loaded with steel underframes for cars, five frames to the car. It is supposed that the stakes holding these frames in place on one of the cars had been broken or dislodged allowing the frames to become misplaced on the car in such a way that they struck the end post of the truss upon entering the bridge. As the river was in flood, the greater part of the span was entirely submerged and under the wreckage of the 20 cars. It will be impossible to determine the cause of the accident until the span can be removed from the river.

SPAN OF WRECKED MONON ROUTE, BRIDGE IN INDIANA

J. A. Ockerson, Noted River Engineer, Dies

After twenty-six years' service as a member of the Mississippi River Commission, John A. Ockerson, noted engineer, died at his home in St. Louis, Mo., March 22 from a stroke of paralysis suffered at his office, March 14, his age being 76 years.



Born in Sweden in 1848, Mr. Ockerson was brought to America by his parents in 1851. He was graduated from the University of Illinois in 1873 with a degree in civil engineering and continued for a period his service in the Great Lakes survey which he had followed during vacations.

In 1876 Mr. Ockerson became assistant engineer on the Eads jetties at the mouth of the Mississippi, thus beginning what was to be his life work. From 1879 to 1887 he was engaged in the survey of the Mississippi River. This was followed by a brief experience as a mining engineer in Colorado. In 1889 he returned to Mississippi River work as chief assistant engineer for the Mississippi River Commission, of which he was appointed a member in 1898, serving thereon until his death.

During President Taft's administration, Mr. Ockerson was consulting engineer on the Laguna Dam across the Colorado River in Arizona and engineer in charge of the work for the protection of Imperial Valley, in California, from Colorado River floods, which included the construction of a dam across the Colorado River from lower California to Old Mexico.

Mr. Ockerson was president of the American Society of Civil Engineers in 1912, and was twice president of the St. Louis Engineer's Club. Four times he was United States delegate to international navigation congresses. He was a member of the St. Louis City Plan Commission.

Army Engineers Named on St. Lawrence Board

Weeks Appoints Jadwin, Kelly and Pillsbury American Members of Engineering Board

Washington Correspondence

The Secretary of War has designated Col. Edgar Jadwin, Col. William Kelly and Lieut.-Col. George B. Pillsbury as the American members of the engineering board which will revise the estimates contained in previous reports on the St. Lawrence River. This work is to be done under the direction of Commerce Secretary Hoover, who is the chairman of the St. Lawrence Commission, appointed recently by the President. The other three members of the board are Canadian engineers.

In commenting on the appointment of the St. Lawrence Commission, noted in these columns recently, Secretary Hoover explained that the Commission's work will be confined entirely to a study as to the proper time to undertake the development of the stream. There no longer is question, he said, as to the advisability of developing both the waterway and the power resources of the river. The only question is when the work should begin. He anticipates some continuance of the opposition from New York and Buffalo to the waterway feature, but he declared that any losses these cities might suffer by reason of the waterway would be compensated by the advantages which would come to them by the development of the river's power possibilities.

Power Possibilities

Mr. Hoover laid emphasis on the fact that there is at this moment a market for the 2,000,000 hp. which can be developed in connection with the project. He pointed out that this fact must be taken into consideration in comparing this project with most large hydroelectric developments where large blocks of power necessarily must be brought in prior to the development of a market to absorb the energy.

It is Mr. Hoover's idea that the Commission should conduct hearings to ascertain whether the work should begin in the near future or whether plans should be made with the idea of beginning the work ten or twenty years hence.

Secretary Hoover emphasized the point that this Commission is dealing with American phases of the question only, and its work must not be confused with the engineering board, of which he also is head. The Army engineers who are to work under his direction will co-operate with Canadian engineers to revise the estimates of the cost of the project. This step is being taken at the request of the Canadian government. The costs contained in the exhaustive reports which have been made on this project are based on prices in effect at the times the reports were made. It is believed that substantial changes in the figures will result from their revision. Secretary Hoover made it practicularly clear that there is to be no new engineering investigation of the project.

Random Lines

Engineers and Draftsmen

"TRAVEL WITH THE WINSHIP—DRAFTED BY TRUNK ENGINEERS."—Advertisement of a Chicago "Luggage Shop."

* * *

Affiliated with Gold Gilders Local No. 278

.."Orange Painters Insist Full Demands Be Met" says a headline in Newark papers. But it isn't a fruiterer's note; the journeyman painters of Orange, N. J., are on strike, that's all.

* * *

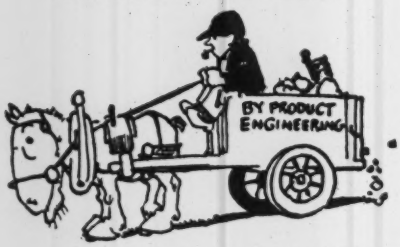
Another Engineering Specialty

DRAFTSMAN ENGINEERS attention! Want to get into a paying game where intelligence pays; sell toilet preparations; commission basis. La Belle Toilet Specialties, 469 Broadway.

—An advertisement in a New York paper.

* * *

In Some Places This Gentleman Is Called a Sanitary Engineer



From the Boston "Herald"

* * *

Some Engineering Studies

"Weight of occupants (of buildings) taken at 150 lb. per person, is probably high, as most of the occupants are females, and some studies indicate that an average weight of same would not exceed 120 lb."—

From the tentative report of the building code committee of the Department of Commerce.

* * *

Sounding the Tocsin

"Members of the Barnes Human Engineering club are asked to meet Thursday at 7:45 p.m. in room 313 Sunset building, to form a class in advanced psychology and metaphysics under tuition of 'Wardelia,' metaphysician, lecturer and author. It is planned that the classes will be held in the park during the summer months."

Like most engineering, please note, it keeps its practitioners out in the open air.

* * *

Have They a Code of Ethics?

The unemployment situation in Seattle, Washington's largest city, is at present rather acute. The mild winter brings many of the tramp class here—a class (practically unknown in Great Britain) whose profession is vagabondage.—London *Times*.

Paving Brick Varieties

In *Engineering News-Record*, April 3, 1924, p. 587, in the article entitled "Recognized Paving Brick Varieties Again Reduced," a typographical error was introduced which altered the sense of the story. In the paragraph which begins "That any type of brick" should have read in its third line "three successive years," making the first sentence in that paragraph read: "That any type of brick which shows less than 2½ per cent of shipments for three successive years be eliminated from the list of recognized varieties," etc.

Railways Projected in Florida

Reports from Florida state that the Florida West Coast Ry., chartered in 1921, is to start construction this year from some point in South Georgia to St. Petersburg and Tampa, Fla. Surveyors are now at work on the line. It is understood that the Illinois Central R.R. is backing this project.

Another report states that the Florida Western & Northern R.R. proposes to build 200 miles of railway from West Palm Beach to Tampa, Fla., at an estimated cost of $6,000,000. The Seaboard Air Line is reported to be backing this project and W. R. Bonsal, a vice-president of this railroad company and president of the Jefferson Construction Co., is stated to be at the head of the new railroad company.

National Conference on Highway Traffic Safety Planned

At the request of Secretary of Commerce Hoover, representatives of eight organizations met with him on April 5, to discuss the feasibility and possible benefits of a conference of national organizations which, by reason of their character, either are or should be interested in the problems of street and highway safety. Attending the meeting were representatives of the Chamber of Commerce of the United States, the National Safety Council, the American Automobile Association, the National Automobile Chamber of Commerce, the National Bureau of Casualty and Surety Underwriters, the American Engineering Council and the American Railway Association.

Secretary Hoover stated that the purpose in calling them together was to discover whether, by a general coordination of effort, a broad national policy with regard to traffic safety could not be devised. While many organizations have definite safety programs the time has come for these organizations to decide on some form of common program in which useless duplication will be eliminated.

It was decided to set up seven special committees: statistics, control of traffic, construction and engineering, city planning and zoning, insurance, education, and motor-vehicle. The personnel of these committees will consist of specialists in their various lines drawn from different organizations which have been studying the problem. Ernest Greenwood was appointed executive secretary of this committee. A finance committee was also appointed.

The conference adjourned to meet again April 19.

Engineering Societies

Calendar

Annual Meetings

NATIONAL FIRE PROTECTION ASSOCIATION, Boston, Mass.; Annual Meeting, Atlantic City, N. J., May 13-15, 1924.

AMERICAN WATER WORKS ASSOCIATION, New York City; Annual Convention, New York City, May 19-24, 1924.

AMERICAN ASSOCIATION OF ENGINEERS, Chicago, Ill.; Annual Meeting, San Francisco, Calif., June 11-13, 1924.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Annual Convention, June 18-20, Pasadena, Calif.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 23-28, 1924.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Boulder, Colo., June 25-28.

The Providence, R. I., Section of the American Society of Civil Engineers and the Municipal Section of the Providence Engineering Society will hold a joint meeting April 22, with Thomas McKenzie, engineer of the water and sewer departments of Providence as the chief speaker.

The New Jersey Sewage Works Association will hold its annual meeting April 25 at the state house, Trenton. Addresses will be given on the sewage experimental work at the experiment station at New Brunswick, by Dr. William Rudolphs, chief of sewage investigations; the new disposal works at Philadelphia, by H. M. Beaumont; and settling tanks, by W. DeWitt Vosbury, consulting engineer, Camden, N. J.

The Chattanooga (Tenn.) Engineers' Club was organized March 31 and will meet weekly, at luncheons. The first officer personnel is: president, O. J. Miller, hydraulic engineer of the Tennessee Electric Power Co.; vice-president, A. F. Perzelius, superintendent of the City Water Co. of Chattanooga; secretary, W. R. King, engineer, U. S. Geological Survey; treasurer, J. E. Morelock, chief engineer of the Converse Bridge Co.

Personal Notes

J. HORACE EATON, Bordentown, N. J., senior examiner of the New Jersey Civil Service Commission, has resigned. Mr. Eaton, who is engineer of the city of Bordentown, will engage in private engineering work.

H. E. WARRINGTON, chief bridge engineer of the California Highway Commission, resigned recently and **HARLAN B. MILLER**, assistant bridge engineer, is temporarily in charge of the department. Mr. Warrington has had charge of the design and construc-

tion of bridges on the California highway system for four years, during which time extensive bridge work has been under way. Prior to his service with the state Mr. Warrington was for eight years bridge engineer for Los Angeles County.

CARL J. KIEFER, consulting engineer, Cincinnati, Ohio, annouces the removal of his offices from the Fourth National Bldg., to the Schmidt Bldg., Fifth and Main Sts.

PHILIP I. BAKER, Winnipeg, Man., who has been district engineer and manager in Canada, for the C. A. P. Turner Co., has been placed in charge of the construction of a large annex for the Maison Blanche store at New Orleans, La.

GIBB GILCHRIST, superintendent of federal-aid projects for the state highway department of Texas, has been appointed state highway engineer of Texas, succeeding Capt. J. D. Fauntleroy, resigned. Mr. Gilchrist some years ago was division engineer for the state highway department, and later, covering a period of two years, was engineer-in-charge on extensive highway construction for Tom Green County, Texas. He served as a captain during the World War.

EDWARD DRAKE, registered engineer of Florida, has been appointed city manager and engineer of Ocala, Fla., succeeding J. F. BRUMBY, JR., who resigned to take a similar position in Sarasota, Fla.

The FREDERICK PAGE CONTRACTING Co., New York City, announce the removal of their offices to 45 East 17th St

EDGAR F. MARTIN is appointed assistant town engineer of Montclair, N. J., to serve for the remainder of 1924, taking the place of JOSEPH COVERTER, who resigned, effective April 1.

W. R. FLACK, of Kokomo, Ind., assistant on the engineering corps of the Pennsylvania R.R., has accepted a position as assistant engineer with the Northern Indiana Power Co.

MAJOR JAMES G. STEESE, Corps of Engineers, U. S. Army, retired, has been relieved from further duty in connection with the Alaska R.R. Major Steese was appointed chairman and chief engineer of the Alaskan Engineering Commission, February, 1923, and upon the designation of the Alaskan Engineering Commission being changed to the Alaska R.R. in August, 1923, he served under the same title for the Alaska R.R. until the appointment of a general manager.

J. B. MCBEATH, assistant city engineer of Moncton, N. B., has been appointed city engineer, succeeding E. W. EDDINGTON, who has been city engineer for many years. Mr. Eddington will remain as consulting engineer. Mr. McBeath was graduated from the engineering school of the University of New Brunswick in 1906. During the war he was an officer in the engineering division of the Canadian army.

STEPHEN J. COSTELLO has been appointed office engineer at Schenectady, N. Y. Mr. Costello was graduated from the engineering department of Union College in 1917, spent a year in service of the U. S. Army as a second lieutenant of engineers, and has served both the North Carolina and Delaware Highway Commissions. He also spent two years in the service of the Portland Cement Association.

ROY ENGELL has been appointed field engineer for the engineering office of Schenectady, N. Y. Mr. Engell is a graduate of Rensselaer Polytechnic Institute, class of 1911, and except for two years in the army, has been with the state of New York on barge canal construction.

LEWIS R. OWEN has been re-elected as borough engineer for Ferndale, Pa.

M. R. KAYS, formerly vice-president and general manager of the Idaho Irrigation Co., Ltd., Richfield, Idaho, and since 1920 engaged in private practice at Phoenix, Ariz., specializing in irrigation and connected with a number of proposed reclamation projects in Arizona, has been made general manager and chief engineer of the Lake Worth Drainage District with headquarters at West Palm Beach, Fla.

WILLIAM H. ELBRING, county surveyor and engineer for St. Louis County, Mo., tendered his resignation to Governor Arthur M. Hyde of Missouri. Elbring, who has held the office continuously for twenty-three years, having been re-elected every four years, stated that his retirement was due to ill health and that he had had the move under consideration for some time. He plans to take a brief vacation and later will enter either the real estate or private engineering field.

Obituary

CLINTON SUMNER BURNS, consulting engineer, and a member of the firm of Burns & McDonnell, Kansas City, Mo., died April 1. He obtained his engineering education at Cornell University and Leland Stanford University, being graduated from the latter institution in 1897. On April 1 of the following year, with Mr. McDonnell he formed the consulting firm of Burns & McDonnell, specializing on water-works and sewage work. Six years ago the firm's name was changed to Burns & McDonnell Engineering Co. and four of the older members of the staff were admitted to partnership. Two years ago a Los Angeles office was opened with T. A. Smith in charge. Mr. Burns was a member of the American Society of Civil Engineers and the American Association of Engineers. Of the latter organization he was chairman of the committee on service and fees until a short time before his death.

HENRY T. DOUGLAS, JR., chief engineer of the Chicago & Alton Ry., died March 31. He was born at Richmond, Va., in June, 1863, and after education at the public schools and in England he began his wide railway experience with the Georgia Pacific Ry. in 1881. He was assistant and resident engineer of the Baltimore & Ohio R.R. in 1886; locating and resident engineer, L., St. L. & T. Ry. in 1887; division engineer, Kentucky Midland Ry., 1888; locating and resident engineer, Seaboard Air Line, 1890; division engineer on the Baltimore & Ohio and locating engineer on the Chicago & Eastern Illinois Ry in 1891, and chief engineer of the Ohio Southern Ry. 1891-94. Then for four years he was chief inspector and assistant engineer in the U. S. War Department, returning to railway service in 1899 as engineer of maintenance-of-way for the West Virginia Central & Pittsburgh Ry. From 1902 to 1912 he was chief engineer of the West Side Belt R.R. of Pittsburgh, and after 1905 he was also consulting engineer for the Wabash-Pittsburgh Terminal R.R. and the Wheeling & Lake Erie R.R. In July, 1912, he was appointed chief engineer of the Chicago & Alton R.R., which position he held until his death. Mr. Douglas was a director of the American Railway Engineering Association and had been a member of its yards and terminals committee for fourteen years. He was a member also of the Western Society of Engineers.

WILLIAM F. CAMPBELL, of the engineering staff of the Canadian National Rys., died at Montreal, March 18, aged 39 years. He had been engaged in engineering work of the Canadian National Rys. at Saskatoon, Sask., and had served overseas during the war.

L. S. BROWN, general manager of the Atlantic Region, Canadian National Rys., died of apoplexy at the general offices of the company in Montreal on April 2. Mr. Brown was 60 years of age and had been engaged in railroad work for forty years. In 1920 he became assistant general manager of the Canadian National Rys. and in 1923 was made general manager.

EDWIN G. SEGROVES, resident engineer on construction for the North Carolina State Highway Commission, died of heart trouble March 9 at Fayetteville, at the age of 54 years. Mr. Segroves' engineering experience covered a period of about 37 years, successively with the Aberdeen & Ashboro R.R., the Durham & Charlotte R.R., and the Norfolk & Southern R.R., as resident engineer on construction. In 1912 he opened an office for private practice in Carthage, N. C., and in 1919 he began work with the North Carolina State Highway Commission.

HOWARD M. JONES, supervising engineer of the Engineering Section, Bureau of Valuation, Interstate Commerce Commission, died suddenly March 31. Mr. Jones was born in Tennessee in 1874, and studied at Vanderbilt University and Union College, being graduated from the latter in civil engineering. His early railway experience was with the Nashville, Chattanooga, & St. Louis Ry. In 1907 he opened an office at Nashville, as a designing and consulting engineer. He designed and supervised the erection of two bridges across the Cumberland River at Nashville, aggregating in cost over $1,000,000, and some 80 to 100 bridges of lesser importance. He was member of the Engineering Board, Bureau of Valuation, Interstate Commerce Commission, from the Southern District with headquarters at Chattanooga, from 1913 to 1921 at which time he was transferred to the Bureau of Valuation at Washington.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Bids on Building Material Speeded by Local Service

Branch Offices Equipped to Give Contractors Prices Without Delay in Consulting Home Office

By N. A. Harris
Detroit Steel Products Co., Detroit, Mich.

MANUFACTURERS of building material or any equipment that enters into industrial or municipal construction could help materially in expediting the preparation of bids to be submitted by contractors, if they could get their estimates and detail drawings or specifications into the contractor's hand in two or three days' time.

The contractor would then have a week or ten days to study the problems before him and draw up his proposal. Under the present conditions, with such limited time for preparing bids, the contractor is practically forced to place his prices high enough to protect himself from loss that might result from hasty and inaccurate estimating of costs. The manufacturer who does a national business finds that distances and slow mail deliveries conspire to frustrate any efforts he may make to get his data into the hands of bidding contractors within a reasonable time.

Responsibility Decentralized

A partial solution of this problem will probably be found in establishing representatives or agents competent to handle all of these essential details without refering to the home office. Such is the policy of the Detroit Steel Products Co., manufacturers of Fenestra steel sash. At the present time this company's field organization is composed of approximately 65 branch offices and agencies, located at advantageous points throughout the country, in charge of men thoroughly trained at the home office to handle all details.

Each one of these local organizations can give advice in planning sash layouts that may save hundreds of dollars and result in a more satisfactory installation; accurately estimate requirements and costs; make detail drawings that conform to the plans of the architect and engineer; assure prompt delivery of the sash when and where needed; and even guarantee an efficient and skillful erection of the sash through the Fenestra Construction Co., a subsidiary of the Detroit Steel Products Co. that specializes in erecting sash. This complete service comprising what is known as the company's five-fold responsibility service, is rendered without reference to the home office.

Such localized service is of inestimable value to any contractor in preparing bids for work in which sash is to be used. Take a recent case that came up on the Pacific Coast, 2,000 miles from the home office at Detroit, as an example of the speedy estimating service a well trained local organization can render.

A Case of Two-Day Service

Plans for a certain structure requiring 800 units of steel sash were submitted to the Fenestra engineers of a local organization on a Friday morning. That afternoon sash detailing and all estimating were completed. Saturday the data were submitted and approved by the consulting engineers and the company's officials at San Francisco and Los Angeles—all in two day's time. Had it been necessary to refer to the home office from ten days to two weeks would have elapsed before the desired information would have been available for submission to the proper authorities. And this same prompt, two-day service would have been available to any contractor preparing bids on this, or any other similar job.

There are 150 different possible combinations of steel sash that may be used to fill an ordinary window opening. These combinations vary as much as 50 per cent in cost. Hence, if sufficient time is available for the preparation of alternate bids, the sash manufacturer might be able to effect a substantial saving in his estimate and the general contractor would be able to submit a more careful and economical bid, resulting in a substantial saving that would more than compensate for the extra time given for receiving bids.

Cement Exported from U. S.

Statistics on the exports of American-manufactured hydraulic cement covering, four-year periods, both before and after the World War, have just been issued by the Bureau of Foreign and Domestic Commerce, Washington, D. C. For the four pre-war years from 1911 to 1914 exports of hydraulic cement from the United States averaged 3,196,547 bbl. per year, valued at $4,659,181. Of this amount Panama imported, yearly, 1,420,151 bbl., valued at $2,076,274, or 44 per cent of the quantity and value. The United States also exported a considerable amount of cement to Canada, averaging 485,191 bbl. yearly, valued at $794,340, or 15 per cent of the total exports from the United States.

For the four post-war years, 1919-22, the United States exported, yearly, 1,939,559 bbl. of hydraulic cement, valued at $6,260,486, a decrease in quantity of 39 per cent and an increase in value of 34 per cent over the exports of the four pre-war years. Cuba was the United States' best customer for cement during the post-war period, importing on an average of 594,529 bbl. yearly, valued at $1,870,011, or 31 per cent of the quantity and 29 per cent of the value.

Program Arranged for Open-Air Road Show

North Carolina Will Be Scene of Projected Demonstrations and Central Exhibit of Equipment in June

FOR the open-air road building and maintenance demonstration to be held in North Carolina in June under the joint auspices of the American Road Builders' Association and the North Carolina State Highway Commission, a program has just been announced. The demonstration will cover the period from June 3 to 10, and will include inspection trips to construction projects on which road-building machinery and materials are actually in use, in addition to a central machinery exhibit to be held at the Fair Grounds in Greensboro, N. C. The exhibit will be directed by Charles M. Upham, chief engineer, State Highway Commission, Raleigh, N. C., by whom it is announced that space will be provided without charge to manufacturers who wish to exhibit or operate machinery on this occasion. The program will consist principally of the inspection of methods and machinery rather than the delivery and discussion of papers, although brief explanations will be presented during the demonstrations.

As previously announced, the demonstration will be attended by a Pan-American highway commission consisting of about forty delegates from twenty South and Central American countries, who are making the trip to familiarize themselves with American methods of highway finance, construction and maintenance.

The central demonstration of equipment at the Greensboro Fair Grounds will open Tuesday, June 3. The first project inspection trip will occur on June 5 and will be followed by others to points where concrete, bituminous and earth road construction is under way. The construction projects visited will be equipped with modern road-building machinery, including tractors, power shovels, graders, concrete mixers, asphalt plants, and other forms of plant.

Brick Makers Elect Officers

The board of governors of the National Paving Brick Manufacturers Association, at its meeting in Cleveland March 26, re-elected the following officers:

Chairman of board, O. W. Renkert, Canton, Ohio; president, R. T. Hutchins, Wheeling, W. Va.; vice-president, Will P. Blair, Cleveland, Ohio; treasurer, C. C. Barr, Streator, Ill.; assistant treasurer, B. L. Beller, Cleveland Ohio; secretary, Edward E. Duff, Jr., Cleveland, Ohio; assistant secretary, S. A. Knisely, Cleveland, Ohio.

One of the first actions taken by the board was the formal welcoming by unanimous vote of the Western Paving Brick Manufacturers Association into membership in the national association. This marks the culmination of the action of the Western association in voting, at its annual meeting in Kansas City in January, to join the national association.

Cast Iron Pipe Production

The Department of Commerce announces statistics on production, shipments, orders, and stock of cast-iron pipe for the month of February, 1924. This report includes returns from eleven establishments and is confined to bell-and-spigot pressure pipe. Reports prior to January, 1924, included returns from 12 establishments, one of which failed to make returns for January and February.

The total tonnage in February for each of the principal items of the industry follows: Production during the month, 78,962 tons; shipments during the month, 69,399 tons; orders specified to be shipped from stock, 37,285 tons; orders specified to be made, 182,649 tons; orders not specified as to size, 2,230 tons.

Water-works Men To Have Special Train to Convention

Delegates to the 44th annual convention of the American Waterworks Association, to be held at the Hotel Astor, New York City, May 19-23, will arrive from middle-western points on a special train for which arrangements have been completed by Walter H. VanWinkle, chairman of the Association's Transportation Committee, and president of the Waterworks Equipment Co., Inc., New York. The special will leave Chicago via the Michigan Central Railroad at 9:45 a.m., central time, May 17. Michigan delegates will be able to board the special at Detroit between 4 and 5:10 p.m. on the same day. A stop will be made at Buffalo at 9:55 p.m.

Reaching Albany on the morning of May 18, the water-works delegation will complete its journey by water on one of the Hudson River Day Line steamers leaving Albany at 8 a.m. and arriving in New York at 5 p.m. For a round-trip a reduction of rates to one and one-half fare has been secured. Delegates purchasing tickets should obtain from their agent a convention fare certificate.

The Exhibit

The exhibit of water-works equipment and materials, an annual feature of the convention, will be staged in the Grand Ballroom of the Hotel Astor, New York. For the Waterworks Manufacturers Association J. E. O'Leary, chairman, J. D. Capron and Charles M. Read are serving as the Exhibit Committee. Material for exhibits should be shipped to the American Waterworks Association, Bush Terminal, 48th St., Brooklyn, N. Y. Bills of lading should be marked: Notify Silsbee Trucking Co., 234 48th St., Brooklyn, N. Y.

Motor Vehicle Production Shows Gain

Production of motor vehicles for the first quarter of 1924 totaled 1,040,755, which is the largest output on record for this period of the year. Each month exceeded the corresponding month in 1923, and the three months' total was 19 per cent greater than for the first quarter a year ago. The March figures, reported to the directors' meeting of the National Automobile Chamber of Commerce at New York April 3, total 356,509, slightly more than March last year, and a 2½ per cent drop from February this year.

Business Notes

John H. McGowan Co., Cincinnati, Ohio, manufacturer of water-works pumping machinery, has just purchased the Twinvolute Pump & Manufacturing Co., of Newark, N. J., builders of centrifugal pumps. The line consists of side suction, horizontally split case, double suction single and multistage pumps made in either belt or motor driven types. Capacities range from 5 to 125 gal.-per minute and heads up to 70 ft. for the side suction pumps. In the horizontally split case design the range of capacity is from 30 to 2,100 gal. per minute for heads up to 230 ft. for single stage and higher heads in the multistage patterns.

Zenas W. Carter has joined the Erickson Co., New York, advertising agency. For the past two and a half years he has been engaged on the special bus promotion program for the White Motor Co. Included in the work on which Mr. Carter previously has been engaged was the development and management of the national program of promotion for the Material Handling Machinery Manufacturers' Association. He also originated and developed the publicity and sales plans of the Granite Paving Block Manufacturers' Association. During the war, Mr. Carter was chairman of the War Service Committee on Metal Lath, stationed at Washington, D. C.

Albert Pipe Supply Co., Brooklyn, N. Y., has acquired the plant and stocks of the Eagle Pipe Supply Co. of Long Island City. It is the purpose of the Albert organization, according to Charles Greenbaum to liquidate the Eagle plant, involving the disposal of 750 tons of pipe up to 20 in.

Equipment and Materials

Wire Fence Highway Guard

To prevent highway accidents at embankments, steep side-hill slopes and curves the Page Steel & Wire Co., Bridgeport, Conn., has developed a woven-wire guard fence fabricated to absorb impact of vehicles. It is designed to replace wooden rails, stone walls and cables along highway danger points.

The guard can be installed in a continuous length for any distance and if one section is caused to sag by a blow, that section can be replaced. It is attached to posts spaced 8 to 10 ft. on centers. The guard is galvanized and painted white, making it easily visible at night. It is constructed of wire-link fabric 24 in. wide. The mesh, formed by No. 9 wire, is square and is 1½ x 1½ in.

Adjustable Width Subgrader Has Turntable Pedestal

The 1924 model steel subgrader, manufactured by the Lakewood Engineering Co., Cleveland, is distinguished by being adjustable in width from 18 to 20 ft., by a new and improved turntable pedestal, and by provisions for cutting the special subgrade cross-sections now frequently specified for a thickened-edge slab. It is usually pulled by a road roller.

Several cuts are necessary to get the grade to final depth; after one cut the

machine is turned around on the forms and a return trip made. For reversing a turntable pedestal is provided. By means of a gear arrangement, replacing the former jack lever, the machine is lifted off the forms and supported on the pedestal. It is then turned lengthwise of the road and after the roller has moved up to its proper place is swung around further and lowered on the forms for the return trip.

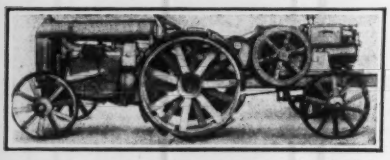
The subgrader is furnished to cut flat, crowned, or the special cross-section subgrades for a slab thicker at the edges than the center. The cutting blades are carried on angles by bolts through slotted holes. The blades can be adjusted on these angles to give the exact cross-section desired, whether flat or crowned. For the "special" subgrades an extension plate is used to carry the blades at each end. This plate is so shaped that the blades are given the correct position to produce exactly the cross-section specified.

On truck haul jobs contractors have found that by using the subgrader from one to three hours per day, when hauling is not in progress, sufficient subgrade can be fine-graded for the entire day's run.

Portable Air Compressor Has Tractor Power Unit

The latest unit to be placed on the market by Schramm, Inc., West Chester, Pa., is a compressor-tractor combination. It embodies the standard type of horizontal, double cylinder, belt-driven air compressor attached to a Fordson tractor. The compressor is mounted on a two-wheel trailer, attached to the standard rear axle housing of the tractor and held in place by a hinged joint which allows the compressor and tractor to be taken over rough and uneven surfaces.

Power is transmitted from the Fordson unit direct to the compressor by



means of a heavy, double leather belt. The wheels under the trailer are the same as those used under the front of the tractor and the steering apparatus is connected direct to the steering wheel of the tractor. The outfit can be moved about on the job, or from job to job under its own power. The self-propelled feature, the manufacturer points out, makes the outfit suited for contracting jobs which require frequent moving of the compressor, such as trench and pipe line work, asphalt and concrete cutting, rock drilling, calking, tamping and other operations.

Schramm compressors for this combination are built in three sizes with piston displacements of 60, 100 and 120 cu.ft. per minute. The 100-ft. unit is popular with the average contractor, because it will handle practically any pneumatic tool.

Publications from the Construction Industry

Water Softener — GRAVER CORPORATION, East Chicago, Ind., has published an 8-page booklet describing its intermittent water softener consisting of two wooden tanks and a gravity filter. No motor is necessary for its operation. Treated water is used from one tank while that in the other is settling. This softener is designed for raw water ice plants of 50 tons or less capacity and for the smaller boiler plants.

Overhead Tram Rail — CLEVELAND ELECTRIC CRANE & ENGINEERING CO., Wickliffe, Ohio, has issued a new 225-p. catalog of its Tramrail system of overhead conveying equipment, illustrating and describing its application in forge shops, sheet metal plants, paper mills, rubber factories, automobile plants, pipe handling warehouses and textile mills.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Will Materials and Labor Be Scarce?

"Unless the public will use some foresight in planning for its fulfillment (the construction program), the demand will run ahead of the existing machinery of production and the public will pay an unduly high price," according to the Committee on Building Conditions of the New York Building Congress.

That awards this year are heavy is conceded. In the Middle Atlantic states, during the first three months of 1924, *Engineering News-Record* has reported contracts aggregating $162,000,000, against $123,000,000 in the same period of 1923. This is an increase of 32 per cent in money value, but, owing to higher costs this year, only 18 per cent in actual volume.

The encouraging factor is that very fair materials reserves have been built up during February and March. This is reflected in certain price concessions, particularly in steel. Cement mill stocks throughout the country were 21 per cent heavier on March 1 than on Feb. 1 or on March 1, 1923. Cement manufacturers are adding equipment to accommodate an annual output exceeding last years' 137,377,000 bbl.—the record.

The lumber market has been slow for the last four or five weeks, while production has proceeded above normal. The heavy demand for brick and insufficient production may bring on a scarcity of that material.

As to a Labor Scarcity

The committee's report says "an abnormally large volume of spring building will undoubtedly create a labor demand far in excess of the available local supply, with the result that building operations generally will be undermanned and completion seriously delayed."

In twenty-one large industrial centers from which labor reports are received regularly by *Engineering News-Record* there is a present scarcity of bricklayers and plasterers. Shortage in these two important trades does delay completion of buildings.

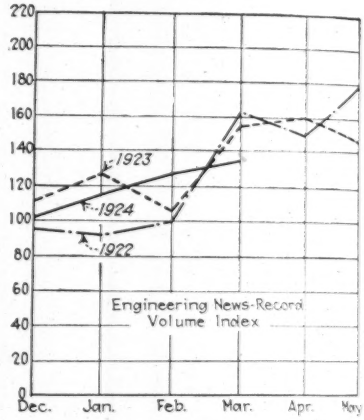
In three of the centers mentioned there is actual unemployment among unskilled and semi-skilled building laborers. One of these centers is in the southwest, another in the Mississippi Valley, and the third on the Pacific Coast.

In New York the shortage of bricklayers and plasterers has become so acute as to necessitate granting bonuses. No unemployment among common laborers is reported.

Next week—Data showing sewer contracts reported by Construction News in first quarter of 1924 are heavier than a year ago.

Increased Winter Work Is Flattening Seasonal Curve.

The New York Building Congress advocates "a general flattening of the seasonal curve" by more winter construction and less spring. *Engineering News-Record's* Construction Volume Index Number shows the development of this movement throughout the entire country during the last three years. The 1924 volume curve approaches the ideal—a flat curve. These curves represent actual physical volume—in other words, quantities of materials—and not mere money value.



The figures given below are volume index numbers for the springs and winters since 1920. They are made from *Engineering News-Record* statistics covering contracts in the United States and Canada, as follows: Waterworks and excavation, $15,000; other public works, $25,000; industrial buildings, $40,000; and commercial buildings, $150,000.

ACTUAL VOLUME OF WINTER CONSTRUCTION

Dec'br.	1920		1921		1922		1923		
January,	1921	48	1922	84	1923	116	1924	121	
Febr'ary,	1921		1922		1923		1924		

ACTUAL VOLUME OF SPRING CONSTRUCTION

March,	1921		1922		1923		1924		
April,	1921	88	1922	168	1923	180			134
May,	1921		1922		1923				

These figures show the recovery of the construction industry—each year heavier than the one before it. More important, in the present question, it is seen that the present increase each spring over the preceding winter has grown vastly less in the last two years. The apparent steady "Flattening of the seasonal curve" is seen in the following figures:

	Increase Over Preceding Winter Per Cent
Winter	
1921-22	75
1922-23	38
1923-24	4
	Increase Over Preceding Spring Per Cent
Spring	
1922	91
1923	7

Production of Steel, Lumber, Cement and Brick Heavier Than Year Ago

March Iron Output Lower Than in 1923—Fewer Burned Brick on Hand With Shipments Heavier During Month

Pig Iron—The March output for the entire country aggregated 3,461,000 tons, against 3,074,000 during the preceding month and 3,523,000 for the corresponding period in 1923. The March production total is only 10 per cent below the May, 1923 record output of 3,867,000 tons.

Steel—The total production of steel ingots for the entire country during March, is placed at 3,953,048 tons or a rate of output nearly equal to that of May, last year, when the peak for 1923 was reached with 4,000,695 tons. The following table shows the monthly production records of the American Iron and Steel Institute:

Month	Tons
1923	
January	3,644,629
February	3,294,264
March	3,858,675
April	3,760,997
May	4,000,695
June	3,574,567
July	3,350,829
August	3,506,755
September	3,173,801
October	3,382,986
November	2,969,012
December	2,711,529
Total	$41,228,739
1924	
January	3,432,541
February	3,604,862
March	3,953,048

Lumber—The lumber movement, according to reports received from the National Lumber Manufacturers' Association, dated Apr. 3, showed some gain in shipments and orders and some falling off in production during the week preceding. As compared with the corresponding week of last year, there was a little gain in production and trifling decreases in shipments and orders.

THE NATIONAL LUMBER MOVEMENT
APR. 3, 1924

	Past Week Ft.b.m.	Corresponding Week in 1923 Ft.b.m.	Preceding Week in 1924 Ft.b.m.
Production	237,895,345	228,656,558	245,984,018
Shipments	239,352,927	247,257,380	227,500,364
Orders	217,350,319	218,157,025	216,069,345

The following figures compare the lumber movement for the first thirteen weeks of 1924 with the same period of 1923:

	Production Ft.b.m.	Shipments Ft.b.m.	Orders Ft.b.m.
1924	2,938,608,392	2,981,300,490	2,948,541,306
1923	2,718,151,408	3,154,296,102	3,201,710,658
1924 Increase	220,456,984	.....	.....
1924 Decrease	.....	172,995,612	253,169,352

Cement—The output for February, 1924 was 8,588,000 bbl. as compared with 8,788,000 for the month preceding and 8,210,000 bbl. for the corresponding period in 1923, according to the Geological Survey. Of the quantity produced during February, 5,933,000 bbl. were shipped from mills throughout the country leaving stocks on hand Mar. 1, at 16,811,000 bbl. The cement situation as to production, shipments and reserve stocks, compared with a year ago, is shown in the following table:

1923	Production (Barrels)	Shipments (Barrels)	Stocks on Hand at End of Month (Barrels)
January	7,990,000	5,628,000	11,477,000
February	8,210,000	6,090,000	13,596,000
March	9,880,000	10,326,000	13,045,000
April	11,359,000	12,954,000	11,463,000
May	12,910,000	14,257,000	10,144,000
June	12,382,000	13,307,000	9,168,000
July	12,620,000	13,712,000	8,081,000
August	12,967,000	14,971,000	6,080,000
September	13,109,000	13,698,000	5,533,000
October	13,350,000	14,285,000	4,612,000
November	12,603,000	10,251,000	6,991,000
December	9,997,000	6,408,000	10,575,000
Total	137,377,000	135,887,000	.....
1924			
January	8,788,000	5,210,000	14,153,000
February	8,588,000	5,933,000	16,811,000

Brick—Reports from the Common Brick Manufacturers' Association of America, dated Apr. 1, show a normal seasonal condition in brick production and shipments. There has been a slight reduction of burned brick on hand, however, and the quantity moved from yards has greatly increased, owing to better weather conditions and resumption of work in the larger cities. Orders on books have not increased during the month. It is also reported that not more than 50,000,000 brick were received altogether from foreign ports during the entire year 1923. The current situation compared with a month ago and one year ago, is shown in the following table:

1923	Burned Brick on Hand M.	Unburned Brick on Hand M.	Brick Moved from Yards During Month M.	Orders on Books M.
Mar. 1	185,094	28,003	.....	302,905
1924				
Jan. 1	313,696	55,646	66,199	266,914
Feb. 1	306,503	38,349	45,762	272,403
Mar. 1	282,813	39,695	104,663	263,219

Aside from a slight scarcity in certain sizes of sewer pipe in some of the Western cities, there is an adequate supply of building materials throughout the entire country. There has been considerable replenishment of steel warehouse stocks during the first quarter of the current year. Increased lumber production during the first thirteen weeks of this year, accompanied by fewer shipments and a lessening in demand, has permitted restocking of dealers' yards. There is more cement on hand than a year ago and manufacturers are increasing plant capacity to accommodate an annual output in excess of 137,377,000 bbl., which was the total for 1923 and the heaviest on record. Unless brick production is speeded up, however, there may develop a slight scarcity during the coming summer. With a cautious buying policy in force at the present time and general hesitancy pervading all basic industries, it is unlikely that the usual seasonal shortage of building materials will occur this year.

Business Briefs

Call money firm with rates from 4½ @5½ per cent, April 7.

Time money has not changed. Rates 4½@4¾ per cent.

Commercial paper for all names ranged from 4½@4¾ per cent.

Foreign exchange:

	This Week	Last Week	Year Ago
Sterling	$4.32⅛	$4.29⅞	$4.65⅛
Franc	0.0577½	0.0551	0.0674
Lira	0.0440½	0.0437½	0.0496½

CONDITIONS OF MATERIALS STOCKS IN IMPORTANT CENTERS

Stocks on hand in approximate figures, example: (Common brick, Denver, 3,000,000); time required for delivery of carload lots to city job, example: (Hollow tile, Atlanta, deliveries take 4 @ 5 days); and stocks on hand in general terms, example: (Sewer pipe, Cincinnati, plenty, all sizes.)

	San Francisco	Los Angeles	Denver	Minneapolis	Detroit	Cincinnati	Atlanta	New York
Sewer pipe	Stocks in usual good condition	Some delay in furnishing small sizes	Still slight shortage	Adequate	Enough in yards for present needs	Plenty, all sizes	Del. take 4 to 5 days	Plenty, all sizes
Cement	Fairly well supplied	No shortage	Enough	Plenty in local warehouses	No shortage; mill stocks increasing	Readily obtainable	From 60 to 75 cars	Enough in dealers warehouses
Lime	Stocks in fair shape	Steady demand without shortage	Sufficient	No trouble in filling orders	Plenty in warehouses	Adequate supplies	About 60 cars	Market well supplied
Common brick	Dealers' stocks in good shape	Well supplied	3,000,000	Readily obtainable from nearby sources	Local yards well stocked	Plentiful	Plenty	No reserves in city; enough in Hudson River yards for next 30 days
Hollow tile	Supply always good	Meeting demand	Stocks replenished	Del. on short notice from nearby plants	No large stocks; enough for immediate needs	No trouble in filling orders	Del. take 4 to 5 days	Del. by water from nearby plants
Lumber	Large reserves, mostly fir	Large quantities coming in continually	Normal	125,000,000 ft. in yards	Normal stocks in yards	Adequate stocks in dealers' yards	Plenty	Del. take 6 to 7 weeks from mill
Asphalt	Very large native reserves	Supplied as needed	Sufficient	Ample	Plenty; shipped as required	Plenty	About 50 cars	Heavy reserves in N. J.
Structural steel	Small supply of blue annealed steel sheets	No delay in mill shipments	Warehouses well stocked	Enough in warehouses	Normal warehouse stocks	Demand mostly for carload lots	From 4 to 5 cars	Adequate; warehouse demand confined to small tonnages

Large Contracts Let During Week

Among the week's announcements of contracts awarded in Construction News, pp. 203 to 218, are the following:

Southern Railway System, Tennessee, to Foundation Co., New York City, $3,000,000.

Hospital, Chicago, Ill., to Dahl-Stedman Co., $2,500,000.

Dam, etc., Tacoma, Wash., to A. Guthrie & Co., $1,162,000.

Plant, Toledo, O., to A. Bentley & Sons Co., $1,000,000.

Bids Wanted on Big Jobs

Among the projects on which bids are either asked or will soon be called for in Construction News, pp. 203 to 218, are the following:

Sewers, Brooklyn, N. Y., E. Riegelmann, $2,900,000.

Hotel, St. Louis, Mo., Mayfair Investment Co., $2,000,000.

Seminary, St. Louis, Mo., for Concordia Seminary $2,000,000.

Protective embankment, Corpus Christi, Tex., City Council, $1,100,000.

Plant, Philadelphia, Pa., for Geneva Electric Co., $1,000,000.

Office, Austin, Tex., W. T. Caswell, $1,000,000.

Plant, North Smithfield, R. I., for Branch River Wool Combing Co., $1,000,000.

Theatre and office, Columbus, O., Keith Theatrical Enterprises, $1,000,000.

Disposal Plant, Howenstine, O., City of Canton, $800,000.

Storm Sewer System, Los Angeles, Calif., Board of Public Works.

Grading, Cleveland, O., $278,000.

Weekly Construction Market

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of Apr. 3, the next, on May 1.

Steel Products:	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Structural shapes, 100 lb.	—$3.59	$4.00	$4.40	$3.30	$3.55	$4.20	$3.60	$3.60	$4.20
Structural rivets, 100 lb.	4.40	4.75	4.90	3.75	4.00	5.15	5.00	4.50	5.00
Reinforcing bars, ¾ in. up, 100 lb.	—3.49	3.50	3.38	3.20	3.45	3.85	3.65	3.50	3.90
Steel pipe, black, 2½ to 6 in. lap, discount	44%	53.2%	43%	47%	55.05%	36%	36.80@49.10%	45%	47.43
Cast-iron pipe, 6 in. and over, ton	61.60@63.60	54.00	61.00	57.20@60.20	61.50	69.00	60.00	65.00	60.00
Concreting Material:									
Cement without bags, bbl.	2.50@2.60	2.35	2.05	2.20	2.42	2.84	2.61	2.90	2.72
Gravel, ¾ in., cu.yd.	2.00	2.00	2.38	2.00	1.85	1.90	2.15	1.50	1.50
Sand, cu.yd.	1.25	1.40	2.00	2.00	1.25@1.50	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.00	2.00	3.50	2.15	3.00	1.90
Miscellaneous:									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	61.00	40.00	60.22	55.00	41.75@43.00	55.00	36.00	28.00	65.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime common, lump, per bbl.	3.00@3.25	1.65	1.85	1.50	1.40	2.70	2.10	2.80	9.50
Common brick, delivered, 1,000	23.65	12.00	+14.10	11.00	15.00	12.00	15.50	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.091	.11	.064	.075	+.075	.....	.11	.115
Hollow partition tile 4x12x12, per block	.1179	.091	.11	.....	.....	+.075	.108	.11	.....
Linseed oil, raw, 5 bbl. lots, gal.	.95	—1.00	—1.10	.94	+1.05	—1.12	1.07	1.15	1.18
Common Labor:									
Common labor, union, hour	.75	.30	.....	.....	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	....	.25	.30@.50	.82½	.50@.55	.35@.50	50	.62½	.25

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b.

Labor—Concrete laborers' rate, 93¾c.; building laborers (pick and shovel men) 75c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.80 for Kelly Island and $1.70 for Sheboygan. Common labor not organized.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered, in iron bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on Douglas fir instead of pine. Sand, stone, gravel and lump lime per ton. Cement, lime and tile are delivered; sand, gravel and stone on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at 98.13). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3-in., $47.43; 6-in. $119.

Weekly Review of the Market

Buying in the current market is confined largely to small tonnage lots for immediate use. There is little purchasing for replenishment of materials' stocks. The price trend has been downward since the last week in March. This week, however, the decline seems to have been checked, with the possible exception of steel, lumber and linseed oil.

Steel structurals dropped 5c. per 100 lb. in New York warehouses during the week ended Apr. 5. This is the first change in steel warehouse quotation in New York City since the price advance in March, 1923.

Douglas fir timbers declined $1 per M. ft. in Minneapolis and linseed oil dropped 2c. in Denver and Dallas and 4c. per gal. in Atlanta since Apr. 3. The lumber drop is due to heavy production in the face of light demand. Minneapolis also reports an advance in flaxseed prices, reflected in a rise of 2c. per gal. in raw linseed oil in that city.

The increased demand for common brick in Dallas developed a price rise of 50c. per M., while an equally slight advance occurred in hollow building tile in Denver.

Telegraphic reports to *Engineering News-Record* from the Seattle district indicate unusual activity in road and bridge construction as the season opens. San Francisco wires that large consignments of cast-iron pipe are being landed on the Pacific coast from Europe.

New York, Boston, Pittsburgh, Baltimore, Dallas, Cleveland, Detroit and Seattle report March building permits far in excess of a year ago, while Chicago, Cincinnati, Philadelphia, Los Angeles, Tacoma, and St. Louis show declines compared with March, 1923.